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editor's letter

Kate de Selincourt's article in these pages on passive house at scale reveals a sector that's beginning to break through into the mainstream. Although we were far from exhaustive, Kate and I did some digging to gain a sense of passive house activity on projects other than single houses in the UK and Ireland. Taking multi-unit schemes alone, there are over 300 passive houses built so far in the UK, with over 1000 more in the pipeline, along with a long list of non-domestic buildings.

Perhaps oddly, the surge of interest in passive house in the UK has happened in spite of something approaching a regulatory vacuum. If we take wall U-values as a measure, Ireland has been ahead of the current requirement in England and Wales of 0.30 since 2002 – on paper at least, and currently requires 0.21 (although in practice, wall values of circa 0.14 are typical, due to the 60% energy reduction target set in the Irish regs). Unbelievably, the British government has proposed the procurement of carbon credits as part of the solution to produce notionally zero carbon homes, is reviewing whether to scrap the Code for Sustainable Homes, and has proposed a risible 6% carbon reduction under changes to Part L.

But suppose the British government upgraded its ambitions and decided to make a genuine effort to dramatically cut energy demand in new buildings – perhaps in preparation for the requirements in the recast Energy Performance of Buildings Directive that all public sector new builds must be nearly zero energy buildings by 2019, before all other new builds follow suit a year later. The question is whether to choose a proven, robust approach based on sound building science, or to reinvent the wheel and produce buildings that tick compliance boxes but may nonetheless ultimately prove needlessly uncomfortable, costly to heat, prone to interstitial condensation – and ultimately to costly repair or replacement.

It's important here to recognise the differences in approach between national building regulations and a voluntary system like passive house. When a government proposes changing building regulations, it has to contend with the lobbying efforts of entrenched stakeholders, and because the focus is on improvements relative to existing regulations, the process is flawed from word go. The lengthy delays and diluted ambitions in Part L 2014 for England and Wales bear this out.

Passive house came about in a very different way, emerging from discussions between building physicists and academics about how to build genuinely low energy buildings. Free from concerns about the impact that genuinely ambitious building standards might have on the construction industry, the people behind passive house didn't have to compromise. Their idea took off, resulting in the construction of tens of thousands of passive houses, many of which have been monitored closely to check their actual performance. If the government ignores such a weight of evidence and reinvents the wheel when setting nearly zero energy building standards, it does so at its own – and ultimately, the building occupants – peril.

Yet in spite of such a poor regulatory environment, passive house is growing strongly in the UK, boosted by the likes of housing associations building passive (and most encouragingly, seeing such positive results that they continue to build passive) and by the first signs of speculative developers signing up voluntarily. There can surely be no stronger sign: passive house's time has come.

Regards,
the editor

2012 Business magazine of the year - Irish Magazine Awards

Jeff Colley:
winner - green leader award - Green Awards 2010

Construct Ireland:
winner - green communications award - Green Awards 2010

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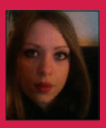

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Cover: Carlow passive house
Photograph: Ros Kavanagh

ABC certificate pending

Passive House Plus (Irish edition) is the official magazine of Éasca and the Passive House Association of Ireland

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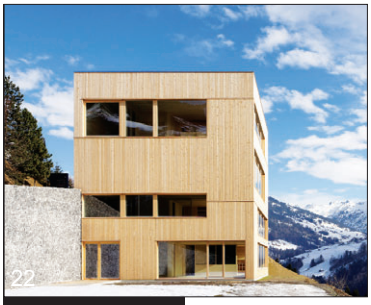


News

UK Passivhaus Conference 2013 review

Fast becoming one of the must attend events in the UK sustainable building calendar, the 2013 UK Passivhaus Conference gave a warts and all insight into passive house in the UK, as ***Kate de Selincourt*** *reveals.*

The 4th UK Passivhaus conference, held this year in Milton Keynes, was completely sold out – fantastic news for supporters of passive house. The one-day programme was crammed with great examples of passive house construction of all kinds, and some very thoughtful insights into what worked – and also what didn't.

Ben Schuster of Willmott Dixon described the challenges they had faced constructing Camden Council's Chester Balmore housing development to the passive house standard – after planning had been granted for a pair of buildings with a complicated form, set in a conservation area.

The fact that Willmott Dixon and colleagues are nonetheless overcoming these difficulties is testament to a lot of dedication and hard work – but the experience added up to a bit of a "what not to do if you are designing a passive house":

- Don't design a really complicated form with lots of angles and overhangs made from heavy masonry;
- Don't locate your ventilation as far as you possibly can from the outside – or you might end up like this building – with nearly 1km of ductwork, responsible for about 20% of all the building's heat loss;
- Don't get tied into a particular window layout without first taking the advice of a passive house specialist. Don't send anything to the planners until you've consulted a passive house specialist.

You could summarise the main learning point as: commit to passive house from the outset, or the whole thing can end up as a kind of passive house retrofit-as-you-build exercise.

Jon Sear of Lancaster Co-housing echoed this point: being committed to the shared goal of passive house in a client group of about 20 would-be householders helped guide their decision-making processes. "When we had to make a choice, it made what could have been long and inconclusive debates a lot clearer – if a change would prevent us achieving the passive house standard, then it was discounted right away," he said.

Again and again we heard how essential collaborative relationships are for success – and relationships with the right people, started early enough, as Jonathan Hines from Architype pointed out. "Get your certifier involved at the start; they are the experts," was one example.

Getting the build quality is not just about great design, it is also about great construction. This means contractors have invaluable expertise too, Hines said. "Get feedback from the contractor on buildability – have them in design meetings even before you go on site if you can."

Matt Wisdom of Thomas Vale Construction reiterated how valuable involvement in design meetings was. He reflected that without this early buy-in all round, it was common "to see the design going from the architect to the contractor, who knocks a few things off and puts in a price, then the QS gets their hands on it and knocks some more bits off, then it goes to the site manager, who somehow has to deliver what the client wanted. Things go wrong, it ends up with everyone arguing, and the lawyers win."

Continuity is invaluable too, several speakers pointed out. Hastoe Housing Association said they found lack of staff continuity with major contractors to be a problem – whereas at Thomas Vale, Matt Wisdom said "we have built a series of passive house schools ... and we have been able to keep the same team throughout. You retain the team, you retain the knowledge."

Skills of course are critical, and Tomàs O'Leary's account of his Passive House Academies in Dublin and New York was a high point of the day for many. Key to the training are the dedicated premises set up so students can construct, then test, real details.

The hands-on training is not only appreciated by craft students – who are after all unlikely to enjoy "death by Powerpoint", but to O'Leary's surprise, it has been equally popular with white-collar design professionals. "What we weren't expecting, but we have found, is that a lot of the people who come on our courses are architects and designers. And they find the hands-on, practical understanding of the processes involved really valuable. It teaches them to optimise for construction, and some have told me they have saved huge amounts of money as a result."

A few sacred cows were challenged, as at any good conference. Passive house building services designer Alan Clarke gave a presentation on simple heating and ventilation in a passive house, and shared a slide from one of his previous projects which showed a water storage tank, a solar pump, a wood burner pump, an underfloor manifold, MVHR unit and a boiler. He pointed out that the capital cost (including solar collectors) was £20,000, and to some people's shock, (as Robin Lewis of Treeco blogged)[1], he suggested that a gas boiler and radiators would be a preferable approach.

Because passive house buildings are so well insulated, he pointed out, you would hardly need to use any gas, certainly not enough to warrant the £20,000 spend on the other kit. And it helps with simplicity of controls too.

Passive house designers often make a point of explaining how they have included a lot of south facing glazing "to maximise solar gain" – including at this event, of course. But one of the points made by passive house consultant Nick Grant in discussing "simple design solutions" was that glazing is expensive (compared to insulated wall), so adding more glazing than was needed anyway for daylight and views is an expensive way to harvest "free" heat – not least because passive house buildings are so cheap to heat anyway.

Thus using typical costs of glazing, Grant calculated that the small amount of extra heating cost 'saved' by additional south glazing was only about £6 worth per sq m window per year – which ended up costing the client 80p (95c)/kWh due to the extra capital costs of the windows, spread over an anticipated 20-year lifespan. But the heat is of course free if you needed the windows anyway.

Grant's thesis was borne out by Dieter Herz's presentation on the Ravensburg Art Museum. Here sunlight has to be excluded to protect the art works, yet passive house was readily achieved via fabric insulation and a simple form.

In the final panel session we heard again that passive house should not be exorbitant – "if your client tells you they can't afford passive house, don't believe them" insisted Dieter Herz. There was anger that the UK government was doing virtually nothing to promote decent building standards, though overall there was a spirit of optimism that such a logical and effective approach to building was catching on, regardless. For airtightness tester Paul Jennings, having seen all too much of the 'bog-standard' UK housing stock, what he valued most was the joy of people moving into passive house. It seemed pretty clear that the attendees left the event fired up to spread a bit more of that joy around.

[1]Thanks to Robin Lewis, who attended this session. His full account of the day is here http://www.treeco.eu/ukphc13/

News

IEA: energy efficiency is world's "first fuel"

Photo ©IEA

Energy efficiency is the world's 'first fuel', and buildings are the sector with the largest untapped economic energy efficiency potential – at a high of 80% by 2035 – according to the International Energy Agency.

The findings were raised by IEA executive director Maria van der Hoeven, and relate to the IEA's Energy Efficiency Market Report and World Energy Outlook 2013.

Far from its previous 'hidden' status, energy efficiency is acquiring a stronger visibility as its real estimated contribution towards energy security and public finances are increasingly quantified. According to IEA calculations, 11 of the IEA member states made energy savings equal to $420 billion (€310bn) between 2005 and 2010, a quantity higher than any other single fuel source. In relation to increasing energy prices, the IEA estimates that the rising energy demand could be decreased from 45% to 33% if new energy efficiency policies were to be put in place.

Unlocking the huge energy efficiency potential in the building stock is recognised yet again in this year's World Energy Outlook as the key stepping stone to achieving these energy savings, both through current and new policies.

The WEO 2013 estimates that "The main driver behind the energy savings in Europe is the implementation of the EU Energy Efficiency Directive. The main components that reduce final energy consumption are the energy efficiency obligation scheme, together with the renovation of the building stock (…)"

Article 4 of the EED requires member states to draw up a long-term strategy for mobilising investment in the energy efficient renovation of their building stock. The deadline for submission is April 2014.

"This will be a key opportunity for member states to elaborate coherent, long-term strategies for their building stock, which looks at the full building in a holistic manner, rather than piece-meal individual measures", explained Adrian Joyce, secretary general of EuroACE. "Maria van der Hoeven describes energy efficiency as the only fuel that simultaneously meets economic, energy security and environmental objectives – member states should drill the deepest well containing this first fuel – energy efficient buildings."

(above) IEA executive director Maria van der Hoeven has described energy efficiency as the world's "first fuel"

Dates announced for 2014 CarbonLite courses

Course dates for 2014's AECB CarbonLite training programme have been announced, with the first course starting on 10 February in London, and the second beginning on 28 April in Plymouth.

"Passive house is rapidly gaining momentum in the UK, becoming an essential skill for architects and consultants, with the Passivhaus Trust reporting that there are likely to be four times the current 250 certified buildings by the end of 2014," said a CarbonLite spokesperson. "The large-scale non-domestic sector is really taking off, from the first certified schools last year to new multi-million pound university buildings, archives and schools currently in design. The industry urgently needs the design and construction sector to up-skill to keep abreast of demand."

AECB CarbonLite courses have now been running and continuously updated for over three years, and offer the chance to gain internationally recognised Certified Passive House Designer status, or to take individual modules to improve specific areas of knowledge.

The courses are uniquely tailored to the UK, showcasing UK examples from the domestic and non-domestic sectors, delivered by UK passive house experts with proven experience of delivering successful passive house buildings.

The two week programme is delivered using a mixture of lectures, group and individual learning, with site visits to innovative passive house developments, and a chance to socialise and build a support network of passive house professionals.

More course details are available at www.aecb.net/carbonlite

News

CPD accredited online passive house tutorials launched

A new online passive house tutorial video series has just been launched by Energyquarter. The series is hosted by Tomás O'Leary from the Passive House Academy, Passive House Institute accredited trainers.

Passive house is fast becoming the leading energy efficiency and comfort standard across the world for all building types. According to Energyquarter's Estelle Cotter, over 40,000 passive house buildings have been built globally including schools, offices, supermarkets and apartments.

"This is a must-view series for architects, engineers, tradespersons, self-builders, planners and anybody who wants to know more about this super energy efficient building method," said Energyquarter's Estelle Cotter.

The series includes in-depth coverage of PHPP, energy balancing, passive house certification criteria, insulation and airtightness levels, U-value and airtightness calculations, blower door tests, windows, solar gain, and much more.

Contribution to CPD learning is a key feature of this tutorial series. With accreditation from the Royal Institute of the Architects of Ireland (RIAI) and the American Institute of Architects (AIA) in the US, participants can test their knowledge with the multiple-choice passive house quiz and gain valuable CPD or continuing education points.

Passive House Plus editor Jeff Colley said: "Energyquarter's passive house tutorial series sheds real light on passive house design, including practical advice on how to achieve the passive house standard. People who watch these tutorials will gain invaluable knowledge in robust, genuinely low energy building. The tutorials achieve something we aspire to in our journalism: they make technical subject matter accessible, but without dumbing down."

The tutorials employ various visual aids such as full-scale passive house construction models and practical demonstrations to highlight key messages. A free preview of the passive house tutorials is available online at www.energyquarter.com

(above) Passive House Academy founder Tomás O'Leary describes the PHPP software in an Energyquarter CPD approved tutorial

Airflow upgrades passive house heat recovery range

Airflow Developments has extended its range of passive house certified heat recovery units with the launch of the Duplexvent DV110SE, and has upgraded its Duplexvent DV50 and DV80 heat recovery units to offer "even more energy saving benefits".

The company said that the new DV110SE utilises state-of-the-art technology, with a patented 'winter function' that protects against frost without any performance reduction. Highly efficient EC motor technology is designed to ensure long life and lowest possible energy use, according to the company.

All units now also boast an automatic by-pass facility that isolates the heat recovery function in response to an increase in the outside temperature, helping to effectively cool the inside air during the summer months and negating the need for expensive air conditioning units.

To ensure a clean, hygienic indoor atmosphere is maintained at all times, standard G4 and high grade F7 supply air filters are also provided together with a G4 exhaust air filter.

The flat Duplexvent DV50 and DV80 units are suitable for both horizontal and ceiling suspended installation in the roof or void space, creating a space-saving solution for specifiers. The units can also be easily integrated into the structure of a building, such as above an entry door, so routine maintenance can be performed from the outside, making them ideal for social housing applications.

"We're delighted to be extending our passive house certified range of domestic heat recovery units," commented John Kelly, marketing manager at Airflow. "The units are not only designed to achieve the most comfortable living environment possible, but to deliver additional energy and cost savings too."

(above) Airflow's newly launched Duplexvent DV110SE heat recovery ventilation system adds to the company's range of passive house certified systems

News

Mark Group EcoHouse opens its doors

The Mark Group EcoHouse opened its doors for the first time in October as part of the University of Nottingham's acclaimed Creative Energy Homes project. Bringing together 12 different energy saving and generating technologies under one roof including external insulation, triple-glazed windows, a heat pump, PV and solar thermal arrays, its aim is to demonstrate how these technologies might be used to improve the energy efficiency of social housing stock and tackle fuel poverty.

"A staggering 2.4million homes in the UK are still classed as being fuel poor and as we work very closely with local authorities and social housing providers nationwide, it made perfect sense to use this house to demonstrate what is possible to achieve," said Bill Rumble, Mark Group chief commercial officer. See markgroup.co.uk/ecohouse for more details on the project.

Meanwhile the company has installed 502 solar panels across three of De Montfort University, Leicester's main buildings as part of a strategic move by the university to invest in renewable energy in order to make energy savings. The move will see the university save around £25,500 on its annual electricity bills.

The installation of two 50 kWp arrays (around 208 panels each) and one 22.6 kwP array (around 94 panels) has cost the university £180,000 to install, but with the energy savings the solar PV will bring to the university, it is expected to break even within seven years and will generate revenue from government feed-in tariffs.

"This is part of De Montfort University's strategic plan to invest in renewable energy and make considerable energy savings going forward," said Paul Eccleshare, energy manager at De Montfort University.

(above) the Mark Group EcoHouse, part of the University of Nottingham's Creative Energy Homes project

Green Building Store launches "cost-effective" timber passive house windows

The Green Building Store has launched its Passive House Institute certified Ecocontract Ultra timber window range to the market. The new insulated frame version of the Ecocontract Ultra range offers whole window U values of 0.68 W/m²K.

The Ecocontract Ultra range has been developed by Green Building Store in response to specifier demand, and is designed to help fill a gap in the UK passive house and low energy market. Ecocontract Ultra's outward opening style is available in a suite of insulated or solid frame versions to give a very high level of design flexibility. In the timber window market, outward opening windows are more familiar to the British public and building professionals, but have been hard to source for passive house projects in the UK.

Green Building Store is hoping that the pricing levels and choice of solid or insulated frame options for the Ecocontract Ultra range will also make it more appealing to the mainstream market, including higher performance social housing.

"Now the Ecocontract Ultra range will be able to give designers working on passive house and low energy projects greater design flexibility," said Chris Herring of the Green Building Store. "It will also offer a cost-effective option for affordable & social housing projects wanting to go down the passive house route. We hope that Ecocontract Ultra will help passive house enter the mainstream in the UK."

(right) the Passive House Institute certified Ecocontract Ultra timber windows boast whole window U-values of 0.68

News

JML Contracts launch off-the-shelf low energy housing

Scottish structural insulated panel experts JML Contracts have brought a series of standardised, low energy structural insulated panel (SIP) designs to the housing market. These off-the-shelf homes are intended to provide more affordable low energy housing, incorporating cutting edge technology in ready-made designs.

"To produce our designs, we teamed up with a certified passive house designer, Colin Potter of Architeco," said John Langley of JML Contracts. "The standard house types have been developed specifically for our SIP system, which is inherently airtight and has negligible thermal bridging. By using the optimum SIP dimensions and designing for passive house suitability, the resulting house designs are extremely cost-effective, super energy-efficient, and can achieve passive house standard."

One of the main features of SIP construction is the lack of cross timber supports in the roof, allowing for excellent use of space below the roof slope. The effect of an open roof space can be quite dramatic, as well as practical.

JML Contracts produce the structural insulated panel systems in its Perthshire factory. The standardised houses are available in two, three and four bed versions, and JML Contracts also offer a full bespoke design and build service for SIPs houses.

Langley reported strong early interest in the houses, with orders starting to come in just as the designs were being finalised. The first of the houses are due to be built early in the new year.

The designs can be customised for individual clients with a degree of flexibility included in the designs, Langley said, but costs are kept as low as possible by sticking to the standard plans.

As well as being an NHBC house builder, JML Contracts also offer services in civil engineering and can provide full in house ground-works and SIP kit supply and erect packages.

(above) a standardised design for a JML Contracts low energy three-bed house

Ecological Building Systems wins two awards at Irish Architecture Expo

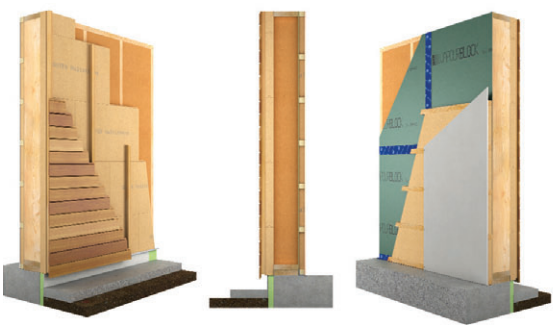
Ecological Building Systems won the awards for best exterior building product and best interior building product at the Royal Institute of the Architects of Ireland's Architecture Expo 2013 show. The company's Passive Eco Wall concept won best exterior building product while the Smart Six Insulation Xpander system won best interior building product.

Passive Eco Wall is designed to provide a complete low energy, diffusion open building concept based on passive house principles. It utilises natural insulation materials supplied by Ecological Building Systems in Ireland and the UK, as well as the Pro Clima intelligent airtightness system. A number of certified passive house buildings have already been constructed based on this concept.

The Smart Insulation Xpander System (Smart Six) is designed to provide greater flexibility in the thermal refurbishment of existing buildings. The system can also be utilised in new buildings. Smart Six creates additional insulation space for roofs, walls and floors in an "effective, economical and safe manner". The system can be applied either internally or externally. The Smart Six system is designed to allow installers more efficiently align rafters or joists and at the same time significantly increase insulation thicknesses in a cost-effective manner.

Ecological Building Systems engineer Niall Crosson said: "We are delighted to have won such prestigious awards. The market demands more innovative solutions to deliver passive house levels of performance and also to tackle a number of the complexities which can arise in the retrofitting of existing buildings. Our Passive Eco Wall and Smart Six solutions both provide innovative practical solutions for both markets."

Ecological Building Systems has pioneered environmental and sustainable building product solutions for over a decade, gaining the sole agency in Ireland and the UK for Pro Clima, the award winning intelligent airtight and windtight building system. The company also supply a range of natural insulations such as Thermo Hemp and Gutex wood fibreboards.



(pictured) Ecological Building Systems' Niall Crosson (centre) accepts Architecture Expo awards from judges Gary Mongey of Box Architecture (left) and Knut Klimmek of Klimmek Henderson Furniture (right); the anatomy of the Passive Eco Wall system

News

EcoHaus bring glazing innovations to Devon passive house

Devon-based Point 6 Projects (point6projects.com) has just completed its fourth passive house project — a striking home on the county's west coast at Croyde. The house includes a unique glazing specification designed by EcoHaus Internorm that enables it to maximise west-facing elevation without the need for solar shading.

The mammoth west-facing glazed face is composed of Internorm HS 330 passive house compliant large scale lift & slide system supplied and installed by EcoHaus Internorm. The glazing extends continuously for 35 metres, stretching 2.7 metres high, and offers 180 degree views of the Atlantic. The largest single section of glazing is 3.5m wide and 2.7m tall, Internorm's largest 54mm triple glazed element to date.

"EcoHaus specified a low G-value to reduce the possibility of overheating through solar gain exacerbated by the large expanses of glass," said Eddie Acford of Point 6 Projects. This allowed the design team to meet the client's desire to design out solar shading.

The HS 330 can deliver overall U-values as low as uW 0.67. The glazing used has a G-value of 0.32, so is designed to reflect peak summertime heat radiation but allow enough heat in during winter to warm the house. This exposed coastal site required a marine-graded A5 finish to the aluminium profiling.

The house, built with traditional concrete block, scored an airtightness test result of 0.5 air changes per hour.

"Historically there have been questions about the airtight integrity of large lift and slide and glass to glass in line and corner joins," Mark Lineham of EcoHaus Internorm said. "But EcoHaus have proved beyond doubt that the Internorm HS 330 can deliver passive houe levels of air-tightness."

The house also includes an Internorm HS 330 2.5m by 2.7m, 385kg lifting sliding door. "The level threshold is unique and running gearing is effortless – a child could open it," Eddie said.

"It's always been the design ethos for it to be a fully certified passive house building," he added. "Our principle aim in business is to deliver passive house. The commitment of EcoHaus and their ability to deliver on time, on budget, with precision installation has made that more achievable."

(above) external shading was designed out by the specification of glass with a low G-value

Power Pipe waste water heat recovery system launched

The Power Pipe waste water heat recovery system has been launched into the UK market. The Power Pipe is a Sap listed heat exchanger that transfers waste heat from outflowing warm water and uses it to pre-heat incoming cold water.

For domestic buildings,the best application of the Power Pipe system is for showers, according to Ashley Prescott of the Code Store, who supply Power Pipe in the UK. He told Passive House Plus that water flowing down a shower drain is typically about 35C, while incoming cold water is between 5C and 10C. He explained that the Power Pipe can be used to preheat this incoming water to about 25C, reducing the load on the heating system.

"It can help reduce total household energy bills by up to 10% and will typically pay for itself after five or six years," he said, adding that while waste water heat recovery systems are not currently widely used in the UK, they are quite popular in mainland Europe and North America.

The Power Pipe can also be used for suitable commercial and industrial buildings that waste large volume of hot water, such as gyms, hotels, hairdressers, and food processing facilities.

"Case studies we have from some commercial installations show systems saving enough energy to pay for the installation cost within a matter of months," Prescott said.

The Power Pipe is Sap Appendix Q listed. "We believe it is one of the most cost-effective ways of improving your Sap score, which will become even more important with the Part L increase early next year." he said. The Power Pipe is available from the Code Store, who supply a wide range of sustainable building products.

(right) The Power Pipe waste water heat recovery system, available in the UK via the Code Store

News

Viessmann opens sustainable production plant

The Viessmann group has opened a new production plant in Turkey, which was created solely using environmentally-friendly, low-pollution and recyclable materials.

Located in Manisa, on the west coast of Turkey, the plant runs entirely on energy from renewable sources. 60 per cent of power is supplied by Viessmann Vitovolt solar PV panels located on the plant's roof, while five of the manufacturer's heat pumps provide space heating. The cooling energy produced by the heat pumps alone is expected to be sufficient to cool the whole plant by 10C in the summer months, when outdoor temperatures typically reach 36C.

The company also recently announced a partnership with East Surrey College to develop a quality training facility for heating installers in the local area and to offer a broad range of products for the college's students to use. The partnership saw the Viessmann training team work closely with East Surrey College plumbing lecturer Darren Carr to design the centre.

The new facility has been equipped with £10,000 worth of Viessmann products, including domestic boilers and solar technologies, and will allow installers to train locally.

Viessmann training manager, Tony Lobley, who recently visited the centre said: "This facility is really outstanding – even better than I expected. The donation from Viessmann for this facility is an investment in the community. It is a commitment to long term training for our installers and the students of East Surrey College who will have the opportunity to use top quality industry products."

(above) Viessmann's new renewable energy-powered production plant in Manisa, Turkey

Infrared heating company aims for UK growth

Heating start-up Eco Infrared Technologies is on a mission to spread infrared heating across the UK, according to the company's Ieva Barauskaite.

The company specialises in the latest infrared heating technologies and offers various infrared heating solutions for domestic, residential, commercial and industrial buildings.

Barauskaite said the company's aim is to become the largest supplier of the highest quality infrared heating solutions in the UK, and to create awareness of emerging new infrared heating technologies and products.

During the past year the company has exhibited at various renewables, building, technology and design shows in Great Britain.

During this year's Grand Designs Live exhibition, the show review committee nominated the company as one of the show's best exhibitors.

"With our ecological and energy efficient heating systems your home or work place will become healthier, cheaper to heat, and a more enjoyable environment," said Barauskaite.

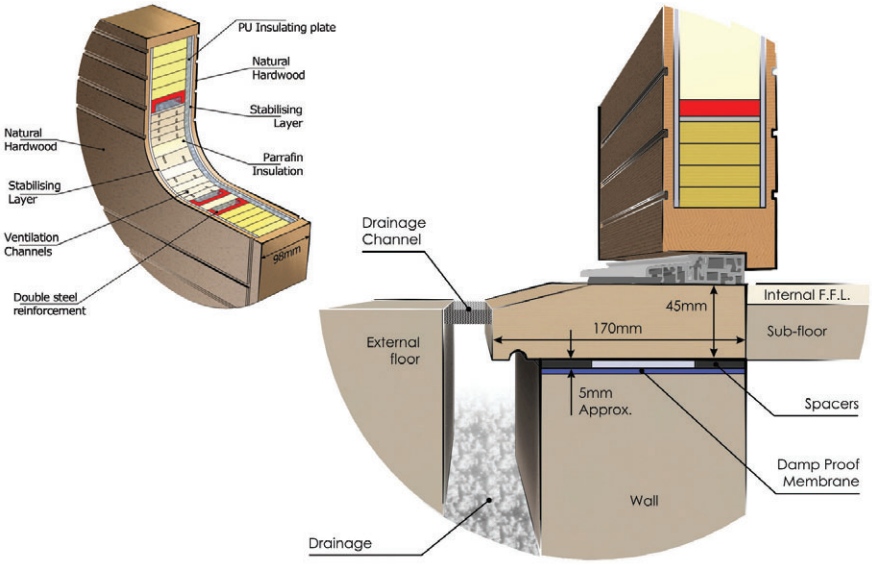
According to Barauskaite, statistics show infrared heating users can save up to 50% on energy costs. "It is scientifically proven that infrared heating is highly beneficial for people with health conditions such as asthma, bronchial ailments or arthritis. Its unique heating method does not create air currents that increase dust circulation in the room. A warm cosy zone is created when infrared heating rays are absorbed into the walls, ceilings and furnishings. This comfort heating system also prevents unwanted humidity that causes mould to grow.

"Infrared heating products are made using aerospace-quality materials and meet ecological standards, so they do not emit harmful electromagnetic radiation," she said.

(left) an Eco Infrared Technologies infrared heating panel

News

Urban Front launches passive house certified door



Door specialists Urban Front have launched the new E98 Passiv door, which has just achieved passive house certification.

This highly insulated door set is made with a steel reinforced core achieving up to 0.8W/m²K and 32db sound insulation with an airtightness up to class three.

These doors are available in most of the Urban Front contemporary door designs (excluding vision panels) and in all of their hardwoods including Iroko, European Oak, American Black Walnut, Fumed Oak and Wenge. The doors are made with triple rebates, steel reinforcement and various bespoke sizing going up to a maximum of 1100mm wide and 2200mm high. The overall door thickness is 98mm, and the doors feature acoustic silicone base weather seals that can withstand temperatures from 70C down to -30C, plus a class four multipoint security lock.

Specialist features such as multipoint and fingerprint locks, reversible electric latches, fire exit quick release locks and automatic door closers are available on request.

(above) section views of Urban Front's E98 Passiv door

Eurosol UK celebrate Sunrise deal with special offer

Leading solar suppliers Eurosol UK have become the exclusive UK distributors for the Sunrise solar photovoltaic range. This adds to the company's broad range of PV solutions, including official distributorship for the Panasonic and Renosolar PV offerings.

"By becoming Sunrise's official distributors we can handle any size of order," said Eurosol UK sales manager Laurence Downs. "We can hold small orders where other distributors might have to order in bulk. This means we can order smaller pallet sizes at no extra cost, meaning we can offer value at any scale."

To celebrate the new business relationship, Eurosol have announced a special offer: a 3.5 KW kit for £2250, including a Powerone PVI 3.6 TL outdoor inverter, with Sunrise 250w polycrystalline panels.

(right) a 140w Sunrise polycrystalline panel, part of the range of PV offerings available via Eurosol UK

SCP publishes rainwater harvesting guide

Rainwater harvesting specialists SCP Water Management have published a guide to help clients, specifiers and contractors ensure risk free design, installation and maintenance of rainwater harvesting systems.

Available on www.scpwatermanagement.co.uk, anyone who downloads the Top Six Rainwater Harvesting Tips guide in December or January will be added into a weekly prize draw for a very seasonal and precipitation related prize – a snow shovel.

Utilising the company's experience in installing systems – including several competing systems – SCP have started providing remedial advice for clients with defective systems.

"We've recently started offering health checks to housing associations, in response to a number of associations looking to decommission defective rainwater harvesting systems," said SCP's Matt Rolph. "The associations are responsible for the system when the contractor's defect period ends a year or two after installation. Normally their staff don't know how these systems work, and don't know what to do with them."

In a move to help ensure the market has positive experiences of rainwater harvesting, SCP's offer includes visiting the site to assess the system, producing a report and proposals for remedial actions.

With systems designed for domestic and commercial applications, SCP offer five-year maintenance contracts, including an annual visit. "Within that five years we'll completely clean the underground rainwater tank," said Rolph.

News

Heritage renovation experts turn to passive house

Chester-based Ecovert Solutions, known as experts in the low energy renovation of heritage properties, has turned its attention to new build too and is at the early stages of planning three passive house dwellings.

The company's Tim Hulse told Passive House Plus that while the company has always been focused on the energy efficient upgrade of historic homes, earlier this year he became a certified passive house designer and made the low energy standard a core part of his business.

"It has changed the direction of the company," he said.

"It was wanting to know more about how to do things better that got me into passive house in the first place. I had been trying to understand more about how buildings behave, and there's not a lot of information around on the physics of buildings. I just kept running into passive house, because that seemed to be the only place where people had sat down and thought about the physics."

He planned to become a passive house designer so that he could apply the Enerphit standard to older properties, but has started working in the new build field as well.

(above) prior to focusing on passive house Ecovert's work focused on conservation, such as this 1880s home, where a damp problem caused by a cement render was solved by replacement with a breathable lime render

"With old properties, you never know what you're getting into until you get the hammer and chisel out. So It's nice to work on something new where there are no historic issues to deal with," he said.

News

Leeds scheme saves space with Kingspan vacuum panels

A new purpose built development of three houses in Buckingham Road, Leeds is the latest project to employ Optim-R, a vacuum insulated panel system from Kingspan Insulation.

The Kingspan Optim-R Balcony & Terrace System installed by APP Construction was the product of choice for architects West and Machell, as it ensured an even transition between the indoor and outdoor levels onto the balcony without losing space from the bedrooms below, while also attaining an impressive U-value of 0.14 W/m²K. This was achieved using 40 mm of Kingspan Optim-R overlaid with 25 mm of Kingspan Thermaroof TR27 LPC/FM.

Steve Sullivan, contracts manager for APP Construction commented: "In this high quality development it was critical that APP Construction maintained all U-values whilst not impacting on the living spaces. The solution proposed following consultation with Kingspan was the Optim-R balcony & terrace system. This allowed us to achieve optimum levels of thermal performance within a very limited floor void. The end result was a very satisfied client."

This "next generation insulation solution" from Kingspan Insulation comprises a rigid vacuum insulation panel which is evacuated, encased and sealed in a thin, gas-tight envelope, giving outstanding thermal conductivity, with the thinnest possible solution to insulation problems. Kingspan Optim-R panels are accompanied by high performance rigid infill panels which can be cut to fit around problem areas such as drainage gutters.

Suitable for both new build and refurbishment projects, and with an aged design value thermal conductivity of 0.007 W/mK, the system provides an insulating performance up to five times better than other commonly available insulation materials, according to Kingspan, and is available in thicknesses of 20 to 60mm.

If installed correctly and protected from damage and penetration, Kingspan said the system will provide excellent long-term thermal performance over the lifetime of the building.

All Kingspan Optim-R Systems come with a supporting design service to ensure that the panels are used as effectively as possible in the space available.

(above) Kingspan's Optim-R panels helped to achieve exceptional U-values without losing space at this APP Construction project in Leeds

St Widnes eco homes feature Lindab Rainline

Lindab's steel-based Rainline rainwater drainage system features on a new 12 unit sustainable social housing project in St Widnes designed by leading environmental architects Denovo Design.

This development, which also provides additional specialist disabled accommodation, incorporates a host of sustainable specifications, such as PV panels, sun tunnels, high levels of insulation, FSC accredited timber and Lindab Rainline.

The outdoor space has maximised the use of greenery, showcased by a spectacular 1.8m high green ivy wall which spans the main access to the site, and provides a natural habitat for wild birds and insects. To further encourage wildlife, Swift bricks have been built as a permanent feature into four of the gable ends.

In keeping with the environmental aspects of the scheme, which was designed to level four of the Code for Sustainable Homes, Denovo Design specified Lindab Rainline. According to Lindab, Rainline has an extremely low carbon footprint compared to other systems and is also low in maintenance with excellent whole life costings.

Its vandal resistance capabilities and robustness were also of particular importance to Denovo Design for this development.

Rainline is manufactured from 30% recycled material and is itself completely recyclable, and is supported by a range of comprehensive performance and installation guarantees.

(above) the Houghton Street scheme was designed to code level four

News

Riomay installs solar PV system at Camebridgeshire cold store

Leading supplier of integrated renewable and traditional energy systems, Riomay worked with Snowmountain Enterprises to install a solar PV system for a cold storage warehouse in Cambridgeshire, generating an estimated power output of 74,096kWh per annum.

The Riomay team, who provide a full design and installation service for those looking for renewable energy options, was contracted to design and install the 2 x 50 kW solar PV system. Helping offset high energy usage on the site, it will also help reduce Carbon Reduction Commitment (CRC) allowance payments for Snowmountain Enterprises.

Riomay offers integrated renewable energy systems with traditional mechanical and electrical project design, allowing customers a complete heating and electrical package. Their service includes solar PV, solar thermal, air, water and ground source heat pumps and rainwater capture.

Ben Skoulding from Snowmountain Enterprises said: “Riomay has served as our preferred PV installer of choice now for the last three years, providing over 300kW of solar energy.

“We have been very happy with the level of service provided by the Riomay team and are particularly impressed with the company’s ability to meet our tight deadlines as required. The solar energy produced, we are delighted to report, is so far exceeding our tenant’s expectations, cutting their energy bills down considerably despite this dull weather.”

(above) Riomay has installed two 50 kW PV arrays on a cold storage warehouse for Snowmountain Enterprises

Munster Joinery turns 40

Munster Joinery celebrates its 40th year in business this year. The company is fully family owned and still operates from the original factory site outside the village of Ballydesmond, Co Cork. The firm said that it has always maintained close contact with its customer base and supports the local economy by providing employment in the region.

The company said that it has grown year on year by building on its strengths – "quality, delivery and service". Founded in 1973 the company operates in Ireland, Northern Ireland and the UK, and has a 910,000 square foot production facility in Ballydesmond, Co Cork. In 1998 a 230,000 square foot manufacturing plant was set up in Warwickshire in the UK. The company currently employs 1,700 people.

Munster Joinery said it looks to the future by using innovative techniques to streamline its processes and to develop products to meet diverse customer requirements. Energy efficiency plays a key role both in operational decisions and product design.

Two wind turbines play a vital role in providing 4.2 MW of electrical energy for day to day manufacturing. A combined heat and power plant uses all timber offcuts and extracted saw dust to produce 2.8MW electrical and thermal energy. A determinedly green waste management policy ensures opportunities for recyling are fully exploited. All of this is designed to ensure that products are delivered to site with low embodied carbon.

To date five Munster Joinery product ranges have been certified as passive house suitable components by the Passive House Institute in Germany.

(above) then and now: Munster Joinery’s Ballydesmond production facility has grown significantly since 1973

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Site location (please list county): _____

Project type (tick box)

New home ☐ Home renovation/upgrade/extension ☐ New commercial/public building ☐
Upgrade/extension to a commercial/public building ☐

Other (please state): _____

Floor area (approx. ft² or m²): _____

Budget (approximate): _____

Stage (tick box)

Initial appraisal ☐ Pre planning ☐ Planning approved ☐ Pre tender ☐
Commencement notice ☐

Project imperatives (tick box)

Certified passive ☐ Near passive/low energy ☐ Indoor air quality ☐ Low running costs ☐
Low environmental impact ☐

Other (please state): _____

Estimated start date (please state): _____

Just tick the products/ services you would like more information on:

- Airtightness & draught-proofing products ☐
- Central vacuum systems ☐
- Cladding & renders ☐
- External insulation ☐
- Flat roofing systems ☐
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- Heat pumps ☐
- Heat recovery ventilation ☐
- Infrared heating systems ☐
- Insulated foundations ☐
- Insulation ☐
- Passive house & low energy build systems ☐
- Passive house consultants & designers ☐
- Passive house training ☐
- Rainwater goods ☐
- Rainwater harvesting ☐
- Solar photovoltaic ☐
- Solar thermal ☐
- Structural insulated panels (SIPs) ☐
- Sustainable architects & designers ☐
- Sustainable building contractors ☐
- Timber frame ☐
- Vacuum insulated panels (VIPs) ☐
- Waste water heat recovery systems ☐
- Windows, doors & roof lights ☐
- Wood fuel / biomass stoves & boilers ☐

I would like my project to be considered for feature in Passive House Plus (tick box) ☐

INTERVIEW:

Passive house pioneer, Prof Wolfgang Feist

We spoke to the Passive House Institute founder about the scientific method, political campaigning and the institute's goals for the future after his keynote address at this year's See The Light conference in Dublin

Wolfgang Feist is a founder and director of the Passive House Institute, one of the originators of the passive house concept, and a professor at Innsbruck University. In his Twitter profile, he describes himself as a "curious physicist with interests in sustainability, energy efficiency especially".

Passive House Plus deputy editor Lenny Antonelli sat down for a chat with him after his keynote speech at this year's See The Light conference, organised by the Passive House Association of Ireland. Like Prof Feist this magazine has always been a big advocate of a scientific, evidence-based approach to building design, so it was no surprise that we found ourselves talking about this from the outset…

Wolfgang: It's very important to do things in a scientific way. Even if you find out things you don't like, it's good to learn the truth. It's always better to "look the facts into the eye", as we say in German, because it doesn't help to believe in something which isn't true.

Lenny: That's something I wanted to ask you about. We get contacted by people who have very (to use one of Wolfgang's own terms) mythological ideas about what sustainable building is: whether it's people who want to promote something like feng shui to all sorts…

W: It's not our main task to fight such movements, as long as they are not against the rational things to do. It's very difficult to move people if they believe in something.

L: Because they're not thinking rationally in the first place, so how do you argue with them?

W: It's very difficult and I wouldn't invest too much time trying. What is important is for yourself to follow a true scientific approach, something the Passive House Plus magazine certainly does. You follow a scientific approach, meaning that if there are new insights, you might change your evaluation. That's just the nature of science. This is the way to go, and it brings us the best results.

L: You said when you were speaking that the most resistance to pushing passive house or the wider energy efficiency agenda is at national government level, and not European or local level.

W: Yes, this is surprising. The European Commission is completely behind the idea, it's very interesting.

I have a theory why it's so much more difficult on the national level: because lobbyists concentrate on that level. There are powerful lobbyists who want to sell their products, and they have a huge influence on the national level, which was the most important political level historically.

L: Are the European Commission at a level so far above national politics that…

W: No surely not – but they are not so important (laughs)! That's one of the reasons. And the second reason is, we have lobbyists in France, we have lobbyists in Germany, we have lobbyists in the UK, but they have different interests. So they can't reach a common lobbyists programme for Brussels. And that's where a rational approach has a chance.

We have seen the car industry influencing Germany, and the Germans stopping a very good proposal from the European Commission [to limit CO_2 emissions from cars], because of lobbying from the specific interests of some national automotive industries… I think the discussion we just had with Mr Pat Cox [former president of the European Parliament] was very interesting. Coming from a European Union level, he sees things exactly the same way.

So that's the way it will work, we can work together with the European Union to promote regional development and bypass national interest groups.

L: Based on today, and on your own travels around Europe, where do you think Ireland is in terms of momentum for passive house and for energy efficiency?

W: Seeing the momentum in this room, it's very advanced. The momentum is very concrete and there are really good examples. I can also tell by your journal. So yes, you are very far and you are not facing a lot of resistance. There might be some resistance, but not the kind I've seen in Austria.

L: From whom?

W: Well, from some big industries. Pushing regulations, making passive house mandatory too fast or even just talking about making it mandatory, brings up resistance. That was what happened in Austria. Most of the time, lobbyists ignore such developments, but when it comes to discussions about making it mandatory, they begin fighting. That's very dangerous for the passive house movement which isn't strong enough yet to fight big industry lobbyists. So the best path is to work together with those who want to make it happen. What you can fight for is incentives — for improved construction, or for better retrofits.

I just talked with Mr Kraft, who used to have a leading position within the German financing institution KfW. They gave out incentives for energy retrofitting of buildings, and still do so today. He told me about a study from Prognos, a big economic institution in Basel, which proves what I've been saying all along but haven't been able to prove thus far — that the money the Germany government spends on these incentives is more than compensated for by the return in taxes [raised from the retrofit activity]. So this is a really good deal for the government.

creates dirt, and it's noisy…so you try to avoid it.

So the fact is you do it and you won't do it again for 40, 50 or even 60 years. That's a long time… On the other hand, from an environmental point of view, it's good to do it only every 50 or 60 years, long lifetimes reduce the environmental impacts.

But that way if you replace a window now, you've replaced it for the next 50 years. So it's really important what you choose now. If a new window costs €400 for example, and it's just €15 more for triple glazing, you would be stupid not to go with triple glazing. This is what I think we should really communicate. If you do something with your building, please think about the choices you make as they will affect your building for the next 50 years. Don't choose double glazing, but triple glazing. Don't add 10cm of insulation but 20cm or 24cm.

L: One thing that we've noticed, and you've probably seen this yourself, from architects who maybe focus more on ecology than energy efficiency, they tend to have a kind of scepticism of airtightness and mechanical ventilation…

W: We had the same discussion in Germany and Austria 15 years ago. But that changed very rapidly. You have to really show what the problem is if you don't have an airtight construction. If your window isn't airtight, you get air exfiltration through parts of your window, you get condensation inside your window, and you get mould growing inside your window… It took only five or six years in Germany and Austria to convince almost everybody that it's a good idea to build airtight.

> "If a new window costs €400, and it's just €15 more for triple glazing, you would be stupid not to go with triple glazing"

L: Maybe it's not the case elsewhere in Europe, but certainly here in Ireland, anytime an argument is made in regards to economic recovery that if you invest a euro you'll get three euro back, they never seem interested in listening to that long term argument…

W: I know, we have had the same discussions in Germany. But with this paper from Prognos, you can really prove it. Everybody talks about the economic benefits of investment in retrofit, but you have to do the research in a proper way. Unfortunately, it is often done incorrectly.

Of course you have to be honest. The state partially funds these extra investments in energy efficiency. Some private money is added to it, so the state will be able to recover some of the money spent through taxes. But on the other side, building owners and residents spend less money on oil or gas or whatever, which in turn results in a tax loss. So you have to look for the real net difference. And the interesting thing is: that difference is positive! That is due to the fact that retrofit work is done with employees here in Ireland, or in Germany, while the other thing [oil or gas production] is done far away. That's what makes the difference.

L:You made some comments recently about the importance of retrofitting to a very high standard rather than, say, a medium standard…do you think that's a mistake that we're in danger of making In Europe right now?

W: Yes that's a big problem. This mistake is being made all the time, everywhere. We have to keep in mind that we are not retrofitting a building every two or five years, because people are reluctant to carry out major renovations. It's clear why — retrofitting not only costs money, it also

Now the discussion on mechanical ventilation still hasn't come to an end in Germany. There are two points to it. One is that some people don't like to have air coming in through a duct. I think by now it has been quite well demonstrated that it works really well. The other thing is cost. And we have to be honest, at the moment, the cost of mechanical ventilation with heat recovery is still relatively high, and it's not so easy to show that it's cost-effective. Today, insulation is cost-effective, triple-glazed windows are cost-effective, but mechanical ventilation with heat recovery isn't quite there yet.

I think what we need now is the same thing that happened with [triple-glazed] windows. When we started using these windows, the extra cost was not €15, it was €150 per square metre, which was far too high. But we knew that we would be able to reduce it. It's the same here.

Look at a laundry machine. Cost? €600. And compare that with a ventilation system. Cost? €2,000 [for the MVHR unit alone]. Now, which of these devices is more complicated?

L: The laundry machine?

W: Definitely the laundry machine. So you see we can reduce these costs, and that is what we have to concentrate on now. This might be another area where we could work together with your journal, launching a competition for really cost-effective ventilation systems. And it's not only a question of the system, it's also a question of how many ducts you are going to install. Looking at what has been built, even in Germany — complicated systems with much too much ductwork. It's not necessary at all.

I think for a dwelling, the costs for mechanical ventilation should be in the range of €3,000 [for the whole system including MVHR unit, ductwork and installation]. That's reasonable and we can get there. And once we do get there, there will be no more discussions, because it's so much better. You can see that at the International Passive House Days, you can ask the homeowners.

That's one of the reasons why the International Passive House Days are so important… People who live in passive house dwellings sharing their experiences is much more convincing than anything that comes from an expert. People don't trust experts any longer, and that's good!

L: What do you think are the biggest misconceptions about passive house?

W: Well, there is one thing at the moment… those who don't like passive houses, they say it's too expensive, something you need a lot of extra money to realise. That's what they're trying to communicate at the moment …Some parts of the building industry wants to counteract the European legislation…they talk about 15% or 20% extra costs, and that's not true!

L: We see projects where someone has built a passive house and then put in a big and complicated heating system. And if they can afford to do that themselves it's fine, but that will be expensive, and I guess maybe that can create the impression that passive house is expensive.

W: That's another reason why it's so important to document good examples. Of course there is scepticism, and as a scientist I think it's good to have a sceptical approach, because there are a lot of people around who promise a lot of things that don't work. And to counteract the skepticism against passive house, you need to show good examples. So we need buildings which really show that it works with a simple heating system, and that it's also very comfortable.

L: What do you think the next big goals are for passive house, both in terms of campaigning and lobbying, and then in terms of the technical side of things — what are the Passive House Institute's next big ambitions?

W: Wow! There are lots of them. The most important thing generally is refurbishment, there are lots of things to be solved there. You know Tomás O'Leary is working with us on the EuroPHit project [an EU backed project dedicated to step-by-step retrofitting]. I think this is the most important issue right now.

And on the other side we are looking at different climates, how to build passive houses in a tropical or subtropical climate. We are in a very early phase of collaboration with the Chinese. China might go passive house soon. That would mean an important contribution to the reduction of CO_2 worldwide, because China is the world's biggest growing construction market.

A beautiful solution

The government's cynical recent energy policy announcements represent a dereliction of duty to the vulnerable and to future generations. There is an alternative, argues award-winning passive house architect ***Justin Bere*** *– and it's beautiful.*

Many of the UK's elderly citizens and low income residents cannot afford to maintain healthy conditions or basic levels of comfort in their homes, while those who are better off often cosset themselves in over-heated homes burning excessive amounts of precious and polluting fossil fuel. Everyone complains about the cost of energy, politicians wring their hands and try to sound as if they have a plan, but little is done to improve the UK's domestic and non-domestic buildings to make them more affordable to run.

"Those who peddle minor gestures in sustainability as if they are an alternative to passive house are either lacking in real knowledge, or simply playing confidence tricks on the public"

In a world where there is a rapidly growing population demanding a share of ever fewer resources, it is unrealistic folly and indeed utterly foolhardy to think that the answer to the high fuel consumption of our buildings is simply to outsource new power stations on guaranteed repayments to meet the unchecked projected future growth in demand. Yet this is exactly what the UK is currently doing. Through sloppy thinking, the UK is mortgaging the future; locking the younger generations into a level of expenditure on fuel that will most likely be completely unaffordable for them. Effectively they will be trapped in a situation with no affordable way out. What is utterly unforgiveable is that the reason for this is that the current generation doesn't want to feel any of the pain of transition. But transition will have to happen in the end and the longer we leave it, the more painful – or catastrophic – it will be.

Yet those of us in the passive house community have demonstrated that there is a solution that can deeply reduce overall energy demand in both new and existing buildings by 80 or 90% while at the same time creating exceptionally healthy and comfortable buildings. New passive house buildings can be built for little or even no extra cost if design priorities are realigned with an energy saving imperative. But even where there are additional costs, such as in passive house retrofits, the costs can be paid back in a lifetime so that future generations are handed an affordable and beautiful solution.

The UK can look back with pride at how its population pulled together and responded effectively to national emergencies in the 20th century. Once again, and as much as at any time before, we need to respond with effective action to what I believe is an even bigger emergency than those faced by previous generations.

Effective action will include re-building the respect for vocational skills, the passion for making things to the best of our ability and to world-beating levels of excellence. It will include renewed respect for world-class engineers and engineering businesses. It will include a transformation of the construction industry from one focussed on what it can take from society, to one focussed on what it can give to society.

All this requires an honest, clear vision which I believe all of us in the passive house community have, and which we must promote. We must point out that those who peddle minor gestures in sustainability as if they are an alternative to passive house are either lacking in real knowledge, or simply playing confidence tricks on the public.

In An Introduction to Passive House (RIBA Publishing, £27.99), I present facts and arguments that attempt to show why passive house is the best form of building for people's health, comfort and general wellbeing, for every age group, for fantastically low energy use, for very low whole-life costs, for the environment as a whole and for the future of the planet.

Embracing passive house technical methods does not mean that we have to turn our backs on beautiful architecture or light-filled, flowing spaces. Passive building techniques give us the opportunity to hold on to the uplifting aesthetic tenets of the very best 20th-century buildings, while at the same time transforming our technical abilities to make social progress and beauty possible in a world where excessive consumption is no longer tenable.

An Introduction to Passive House shows that the economics of passive house are clear. While shifting priorities is a simple lifestyle choice for many, for others the help of responsible, intelligent and forward-looking governments is needed in order to make it easy for individuals and organisations to make steps now, for the benefits of both themselves and of society at large, now and in the future.

Passive house is emphatically not a product, nor does it require designers to use particular products. The Passive House Institute offers manufacturers technical assistance to improve their products, and provides quality assurance certification, but passive house buildings can be built without any certified products. Passive house is a standard and an advanced method of designing buildings using the precision of building physics to ensure comfortable conditions and to deeply reduce energy costs. It does what national building regulations have tried to do. Passive house methods don't affect "buildability", yet they close the gap between design and performance and deliver a much higher standard of comfort and efficiency than government regulations, with all their good intentions, have managed to achieve.

The in-use performance data from passive house buildings shows that to provide comfort, to save energy, to reduce bills, to protect people from fuel poverty, to reduce excess winter deaths, to save money in the long run and, arguably most importantly, to reduce CO_2 emissions, it is difficult to escape the conclusion that deep, energy-saving passive house retrofits and new-builds must become the norm. A deep, energy-saving retrofit programme will create jobs now at the same time as saving money on fuel imports, both now and long into the future. Vast amounts of money can also be saved by reducing the need for new power stations and for long-term storage of nuclear waste, and by reducing the serious impact upon the National Health Service of the UK's dreadful, damp and draughty buildings.

In concluding I will repeat the question that visitors to passive house buildings seem to ask more than any other: Why aren't all buildings built like this?

An Introduction to Passive House by Justin Bere (RIBA Publishing) is available now at RIBA Bookshops (ribabookshops.com/passive)

INTERNATIONAL SELECTION

This issue's selection includes an Estonian space-saving modular build that would see its space heating demand fall by eight if built in Dublin's climate; a family home on a tight site that became Seattle's first passive house; an ultra low energy Italian timber box that acts as a confident, sustainable response to a natural disaster; and a passive community centre in the Austrian Alps that makes stunning use of timber.

Photos: Hanspeter Schiess, courtesy of Cukrowicz Nachbaur Architekten

Community Centre, St. Gerold

The community of Saint Gerold occupies a steep southern slope in the Austrian Alps, commanding sweeping views across the valley below and the mountains beyond.

The municipality's new passive house community centre, finished in 2009, is home to a preschool, playgroup, shop, function room and local authority offices.

The form of the building references the neighbouring schoolhouse, which is a protected structure, and the local church too. Sited at the entrance to the village, the new building acts as a gateway to this remote community. It's also the first four-storey timber building in Vorarlberg, Austria's westernmost state.

The centre was constructed from prefabricated timber walls panels, most of it sourced from St Gerold's own forests. All sawmill and joinery work was carried out in the neighbouring village.

The building isn't just about energy though, but ecology too: the timber framing is insulated with sheep's wool and wood fibre, materials like PVC and paints with heavy metals were designed out, and even the elevator was constructed with wood.

The building's space heating demand is 14 kWh/m^2/yr, and any warmth needed is provided by a geothermal heat pump, which also provides cooling in summer. Waste heat dumped by the shop's cold store is also captured for space heating.

And with 2,000 metre mountains rising above the valley, the views aren't bad either. ▶


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Park Passive, Seattle

Situated in Seattle's Madison Park neighbourhood, Park Passive is the city's first certified passive house. Designed by NK Architects and constructed by Cascade Built earlier this year, the four-bedroom home uses 75-80% less energy than a house built to the state's building code.

"Passive house's focus on performance, human comfort and simplicity aligns well with our approach to design," says Boyd Pickrell of NK Architects. "It supports our mission to create dense urban housing that is responsive to people's needs and supportive of highly sustainable lifestyles."

The tiny site was tricky for the designers of the house, which has meaty 450mm double-stud walls and 600mm of insulation in the roof. Airtightness is provide by the internal OSB board, sealed up with Siga tapes. Triple-glazed Intus windows were imported from Lithuania.

The home's vaulted ceilings connect the main living area to an upstairs play area, while the daylit open staircase showcases wall panelling from a tree salvaged from the site. Salvaged wood was also used for the stairs and a bathroom counter. The rooftop deck offers views of Lake Washington and the Cascade mountain range.

"Inefficient buildings are the number one consumer of energy in the world, and the largest contributor to climate change," says Cascade Built founder Sloan Ritchie. "Passive house design standards offer a way forward towards net-zero building with strategies that are relatively easy to implement – better windows and doors, more insulation, improved air sealing. Unlike asking people to stop driving their cars, passive house reduces our carbon footprint while increasing comfort and quality of life." ▶

Photos: Aaron Leitz, courtesy of Cascade Built

Photos: Architect11

Passion Group Smart Design House, Estonia

Passion Smart Design House is a prefabricated modular design by the Passion Group and Estonian firm Architect 11 — and this recently completed 40 square metre version is the first prototype built.

Designed to be erected in just a day or two — with most work done off-site — this unit is intended as an addition to an existing house, or as a guesthouse or holiday cottage.

The structure is delivered fully furnished, with furniture and appliances "attached" inside. The architects say that by constructing the house in-factory and minimising time on site, they reduce their impact on the local environment.

The dwelling is constructed from a glulam frame that's insulated with mineral wool, and solar thermal heating features too. The house was designed with PHPP, though the architects say that some assumptions made by the software — that the house will be occupied year round, for example — do not apply to this prototype unit.

This building's space heating demand is 54 kWh/m^2/yr — well outside the passive house standard of 15 kWh/m^2/yr. But architect Eero Endjärv switched the climate setting for the house to Dublin, and the space heating demand dropped to just 7kWh/m^2/yr — meaning that if this was built in the Irish capital, it would be a passive house. ▶

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Photos: Pierluigi Bonomo

Energy Box, L'Aquila

The larch-clad Energy Box in L'Aquila, Italy has replaced a home destroyed during the 2009 earthquake that devastated the region. Architect Pierluigi Bonomo wanted Energy Box to mediate between the past and future, so this new low energy dwelling rests inside remnants of the original house's stone wall: the old stone walls reflect the past, while the new energy efficient, lightweight, earthquake-proof timber structure points to the future.

Completed this year, the house was constructed from cross-laminated timber, and the walls are insulated with glasswool insulation internally and woodfibre externally. On the south facade, wide gaps between the larch planks allow for natural lighting and solar gain, while sliding timber screens provide summer ventilation.

Energy Box was constructed to the Italian Climate House Gold standard, which requires thermal-bridge free construction, a space heating demand of 10kWh/m²/yr, and airtightness of less than 0.5 air changes per hour – levels which, without interrogating the inner workings of the standard, all seem tighter than the passive house requirements. (As an aside, there's an argument about whether tighter standards than passive house are necessary, given the diminishing returns involved).

The house's tiny heating demand (7kWh/m²/yr) is provided by heat recovery ventilation and a few small electric radiators. Energy Box also makes rich use of materials salvaged from the demolition of the old house, such as stone, steel and wood.

The house features a solar photovoltaic facade too, and another PV panel on the roof. This means the house classifies as "nearly zero energy," according to Bonomo.

NORTHWEST facing home shows passive flexibility

Not every site lends itself towards passive house, or so the story goes. Intent on making the most of spectacular views to the northwest, Rob Davies and Amy Staniforth's ecological self-build shows that passive house can overcome orientations that turn their back on the sun.

Words: Lenny Antonelli

Artist Rob Davies and his wife Amy Staniforth didn't set out to build a passive house. "We were just aiming for something that would keep us warm and wouldn't cost the earth," Rob says.

The couple started looking for a plot a few years ago, before they got married. Rob was living in Worcestershire, where he'd built his own studio. Amy was working at Aberystwyth University in west Wales.

They looked at sites in both locations, and half-way between, but ultimately decided to settle in Tre-Taliesin, near Aberystwyth. "As long as I've got a studio I can work anywhere basically," Rob says.

They bought a site, and Rob started sketching designs for the house. They both wanted to maximise views facing north west to the sea and hills.

"I kept drawing the house with Amy, and imagining what it would be like living there, and imagining what it would be like to work there," Rob says.

If you keep doing that over and over again, he says, and keep making mistakes, you eventually get it right.

"We were interested in the process, so we went through it ourselves rather than just giving it to an architect. We could have designed a much flashier building, but we just wanted it to work."

One of the early design challenges was posed by the couple's two dogs and two cats. "We had to design the house so they could co-exist but not meet each other."

Rob and Amy had already secured "reserved matters" planning permission when they met local heat pump engineer John Cantor, who recommended they talk with passive house designer Nick Grant. Rob called him, and Nick agreed to come on board as passive house consultant.

Rob decided to act as project manager. "I think in a way that's not such a bad thing if you're spending your own money," he says.

He hired architects Daffyd Tamos to help make his designs a reality, and appointed local firm Tai Dyfi as the contractor. Rob and Amy knew from the start that they wanted a timber house — not just a home built from timber, but clad with it too.

And indeed wood is at the heart of the structure: the walls are timber frame, they're insulated with 350mm of Warmcel, and clad with Welsh red cedar weatherboard. Airtightness is provided by a Pro Clima Solitex DA membrane, supplied by the Green Building Store.

The roof features 400mm Warmcel-insulated Steico rafters, and a Proclima DA membrane for airtightness.

Powys-based company PYC Insulation (formerly Pen y Coed) installed the Warmcel insulation, while their sister company PYC Systems carried out the final airtightness test, which produced a result of 0.365 ACH — an improvement of around 22% on the first test result.

"The second tests were carried out after second fix, but we believe that the main reason for the improved score is the full-fill of Warmcel," says PYC's Rich Hibbert. "We have carried out other tests over the years and have come up with very similar results."

The windows are Optiwin Alu2wood triple-glazed units, which were supplied by the Green Building store and have an overall U-value of 0.77.

Photos: Rob Davies

But when it came to sealing the building envelope the pets again posed a challenge: how do you make a cat flap airtight?

For Rob, the answer was to make one himself: a simple box with a flap on either end that's surrounded by insulation and taped in place. Rob had seen an airtight cat flap online for $1,000, but his version cost just £25.

"One of the cats, Parsnip, she actually sleeps in it," he says.

Mike Neate of ECO DC, airtightness consultant and window fitter on the project, says there was a substantial difference between the pressurisation and depressurisation results on the first airtightness test. This is because during depressurisation, membranes and tapes are "sucked" against the building structure, improving the seal. This helped the team diagnose a leak at one window box.

One gable wall was built too high during construction. Mike Neate says this would have led to thermal bridging where the gable structural stud passes through the roof insulation zone, and would have been tricky to seal for airtightness, so the height of the wall was lowered.

Rob says one of the best decisions he made was getting the whole project team together for a planning session twice prior to the build commencing to hammer out any issues.

"I guess that really did help, because the build went smooth," he says. “The contractor or his guys turned up every day of the build at 8am and left at 5pm and were very conscientious in their work, even though it rained almost every day they were on site.”

Rob looked into all sorts of ways to heat the house. There's no gas network in the area, and he didn't want to store fuel on site either. He was also keen for the heating to be as automated as possible, so he ultimately plumped for a ground source heat pump, supplied and installed by John Cantor.

"The first decision was between a high and low temperature range heat pump," John says. Rob went for a high temperature unit because, in a passive house, hot water rather than space heating is the biggest load.

"The second decision was buffer cylinder or no buffer cylinder. Since space was limited, we decided to use the floor screed as a buffer.

"The house is such a fantastic pleasure to be in. I'm sitting at a window now looking out towards the sea. It's been 20.5 degrees or above for the 8 months we've been here."

This provides enough mass to absorb heat and minimise cycling of the compressor,” John says.

To aid buffering, 900 metres of underfloor heating pipe was laid down under the polished concrete floor. Extra underfloor heating was installed in the downstairs wet room and the studio, in which he works all year round and is single storey. Rob and Amy helped John install the pipework.

There's also a twin-coil 260 litre Newark Copper Cylinder for hot water, fed by the heat pump and two Velux roof-integrated solar panels, supplied by local firm Llani Solar.

The team decided to remove all but one thermostat from the house for the first year as an experiment. They'll monitor the performance of the house closely for 12 months, then decide what kind of control setup will work best. "The house is mostly open plan, and being a passive house, the rooms tend to equalise," John Cantor says, "in part due to the self-regulating effect of underfloor heating in such a well-insulated house." ▶

(below) Various stages of the wall build-up showing, from left, the Solitex DA membrane; the larsen truss; the Hunton Sarket fibreboards; airtight tapes to cover cellulose drill holes in the fibre board; (p33, clockwise from top left) 900 meters of underfloor heating pipework was laid; the timber frame taking shape; an airtight catflap, built by the client for just £25; the windows were installed proud of the main timber frame, to form a complete insulation layer once cellulose is added

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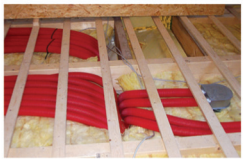

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Robert Davies' home - Tre Taliesin, Ceredigion, Wales 2013

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The house has a 3.4kW solar PV array too, also supplied and installed by Llani Solar. At the time of writing it has produced just under 3,000 units of electricity — compared to 1,000 consumed by the house.

At one stage Rob considered ditching the PV to save money, but ultimately put it in. He's not regretting the decision. "You feel like you're making less of a mess of the world," he says. "Now we're really pleased with it."

He's happy with the solar thermal too. "It's lovely to think you can have a hot bath or whatever, and there's no cost."

Nick Grant says when he came on board, meeting the passive house standard didn't look feasible. A mountain to the south east reduces solar gain, and there's glazing to the north — not ideal for maximising passive gains. ▶

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But on the other hand, the house has excellent airtightness and a decent surface-to-volume ratio to its advantage. The wall and roof U-values are also superb.

The design heat load is 10 W/m², while the space heating demand is 14 kwH/m²/yr, meaning the design meets the passive house standard even though Rob isn't looking for certification.

"Overall I think it is a lovely building and I look forward to return visits as it settles into the landscape," Nick Grant says.

Almost as soon as Rob and Amy moved in, west Wales experienced a spring freeze."Considering the plaster had only been on the walls a few weeks, and the concrete still hadn't dried out, it was amazing," Rob says.

"The house is such a fantastic pleasure to be in. I'm sitting at a window now looking out towards the sea. It's been 20.5 degrees or above for the eight months we've been here."

Rob says his 88 year old father, who was a builder himself, had told him: "You don't build your own house, you build other peoples' houses."

But then he came to see it. "It was great, they were really blown away. My dad said to me 'I can't believe you took this on, but it's really good'. And I was dead chuffed."

SELECTED PROJECT DETAILS
Clients: Rob Davies and Amy Staniforth
Architects: Daffyd Tamos
M&E consultant: Alan Clarke
Civil & structural engineering: Bob Johnson Consulting Structural Engineers
Passive house consultant: Elemental Solutions
Contractor: Tai Dyfi
Heat pump design: John Cantor Heat Pumps
Heat pump: Kensa Heat Pumps
Airtightness consultant & window installer: ECO DC
Cellulose insulation & airtightness contractor: PYC Insulation
Cellulose insulation: Warmcel
Airtightness products: Pro Clima, via Green Building Store
Windows & doors: Optiwin, via Green Building Store
Solar thermal & PV: Velux/ET Solar, via Llani Solar
OSB: Norbord
Rafters: Steico
Sarking boards: Hunton Sarket

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PROJECT OVERVIEW:

Building type: 210 square metre detached two-storey timber frame house with single storey studio attached.

Location: Tre Taliesin, Nr Machynlleth, Ceredigion, Wales

Completion date: February 2013

Budget: Build £290K (£375K including purchase of land)

Passive house certification: Not sought

Space heating demand (PHPP): 14kWH/m²/yr

Heat load (PHPP): 10kWh/m²/yr

Primary energy demand (PHPP): 74kWh/m²/yr

Airtightness (at 50 Pascals): 0.365 ACH

Energy performance certificate (EPC): A 97

Ground floor: 50mm sand at bottom, followed above my 250mm EPS, 300 micron Radon screen, 250mm C35 concrete reinforced by 10mm steel (200x100mm), powerfloated then polished. U-value: 0.135

Walls: 20mm welsh red cedar weatherboard on 25x50mm vertical battens against 18mm Hunton Sarket board on the outside of 350mm deep Warmcel-insulated larsen truss (with 9mm fin) then Solitex DA airtightness membrane, 11 mm OSB sheathing on 89x50mm stud frame with full quilt insulation then 12.5mm plasterboard and skim. U-value: 0.095

Roof: Cupa R4 natural slates fixed with copper nails on 25x50mm s/w battens on 50x50mm counter battens sitting on 18mm Hunton sarket board glued and screwed to rafters. 400mm deep Steico rafters filled with Warmcel on 12 mm OSB to underside of rafters. Proclima DA membrane taped with Tescon Vana then 25x50mm battens and 12.5mm plasterboard (not foil backed). U-value: 0.099

Windows: Optiwin Alu2wood triple-glazed, argon filled, timber internal aluminium external windows supplied by Green Building Store with overall. U-value: 0.77 W/m²K

Heating system: Kensa KR4190 3.5kW single compressor high temperature heat pump drawing from 400 sq m of horizontal collectors with 900m of armoured underfloor heating pipe set in the raft concrete foundation running at 23C. 260 L hot water tank with two Velux U12 solar thermal collectors totalling 5 sq m.

Ventilation: Paul Novus 300 MVHR, with a Passive House Institute certified efficiency of 89%

Electricity: 18 sq m ET 660 solar PV array with annual output of 3.3 kW

Green materials: cellulose insulation, Hunton Sarket board, Steico rafters

Social scheme finds value in passive

With social housing tenants let down by substandard energy efficiency requirements under UK building regulations, some switched-on housing associations are taking matters into their own hands and building to the passive house standard. Broadland's first certified passive scheme in Norfolk is a significant step on one association's journey towards social housing fit for the 21st century.

Words: Lenny Antonelli

We tend to think the worst examples of social housing — decaying tower blocks, huge isolated estates — are from the past. But just how good is the social housing we're building today?

Energy consultant Andrew Fisher says because budgets for social housing projects are typically low, corners are often cut. "Typically social housing is deemed to be 'house bashing' with little need [for] skill and finesse," he says. "It typically seems to be done at such a low cost — because there's very little money — that quality slips." This means the cheapest materials are chosen, and the price paid to subcontractors is pushed down.

Fisher played a big role in the construction of a four-unit passive social housing development in the village of Fulmodeston, Norfolk, in his previous role as sustainability manager at contractor Lovell. He has since left to start his own consultancy, AMF Consulting.

He says that passive house, "forces trades to do the job correctly, and this was evident at Fulmodeston by the result."

The scheme was developed by the Broadland Housing Group, who were gifted the site by local landowner Lord Hastings. North Norfolk

Photos: Peter Cook

suffers from high levels of fuel poverty due to the lack of a gas network, old housing stock, and low incomes.

Broadland's head of development Ed Mumford-Smith says that before Fulmodeston, the group had built schemes to levels three and four of the Code for Sustainable Homes with mixed results. The more successful projects tended to be those with a 'fabric first' approach that focused on insulation rather than bolt-on technologies.

Fulmodeston presented a good opportunity for the association to build its first passive house scheme, ahead of a planned 250 unit passive apartment development on Norwich's Carrow Road due to commence in 2014. Broadland planned the project alongside a similar development in Barney, the neighbouring village. The latter scheme was designed to get close to — but not quite reach — the passive house standard.

"It was also an experiment to see how those houses [at Barney] performed against passive house standards," says Ian Bramwell of Mole Architects, who designed both schemes.

Mole had been approached directly by Lord Hastings, who admired the firm's work, particularly on their barn-inspired Black House in Cambridgeshire.

The design at Fulmodeston is partially inspired by the village's existing 1950s social housing. The new scheme's black roof tiles are also particular to this part of Norfolk.

Having worked extensively in timber frame, this was the natural choice of building material for Mole. The walls at Fulmodeston are insulated with 235mm of polystyrene bead, with an additional insulated service cavity of 45mm.

In the attics there's 500mm of Knauf Earthwool Loft Roll 40 on the flat between the joists, while in some areas the first floor ceiling is hipped and there's Knauf's Rafter Roll 32 between the rafters. Both insulation products were supplied by the Mark Group. The ground floors feature 200mm of Celotex PIR insulation, while the windows are Passive House Institute certified timber-aluminium Internorm HF 300 Edition units, supplied and fitted by Eco-Haus Internorm.

Marmox Thermoblock was used under door thresholds to prevent thermal bridging here. Thermoblock is an insulating, load-bearing block composed of a rigid epoxy-concrete frame integrated with an XPS core. ▶

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In the walls and rafters, airtightness is provided by a Pro Clima Intello Plus membrane, which was supplied by Irish company Ecological Building Systems. All four units beat the passive house airtightness standard of 0.6 ACH.

Ed Mumford-Smith says the project involved "a lot of quality control, and a lot of commitment." About 300 inductions were carried out to teach staff the principles of passive house.

Heating, if needed, is provided by a single Dimplex electric storage heater in each house, and a single towel radiator in the bathrooms. "When you look at the passive house building physics, it's about getting the heating demand so low that you don't need a heating system," says Ed Mumford-Smith. But additional fused spur points have been installed so further electric panels can be installed if needed.

“The design team ensured that the design was modelled in detail at a very early stage to ensure that we would have comfort in the heat demand and heat load,” says Andrew Holmes of ALH Design, M&E consultants on the project.

Each house also has a single three-square metre Viridian Clearline V30 solar thermal panel, connected to a 210 litre solar cylinder, with back-up immersion. Ventilation is provided by Zehnder ComfoAir 200 Passive House Institute certified heat recovery ventilation units, which boast 92% heat recovery efficiency.

Tenants started moving into the Fulmodeston scheme at the end of July. When Passive House Plus spoke to resident Claire Murdoch in October, she said temperatures inside had been averaging 21C or 22C. “Sometimes it gets a bit cooler if we've been out and there's no appliances on.”

She had yet to use either her electric panel heater or towel radiator. The only real learning curve, she said, is knowing when to turn on the back-up immersion.

"Sometimes the weather isn't as good and we don't have as much hot water, so we've got a back-up immersion. That's the thing I'm still getting my head around at the moment.”

She notices heat traveling around the whole house after cooking or baking far more in her new house. Her electricity bills had averaged £30 a month until October. Overheating hasn't been a problem either. “Even when we had the hot weather, the temperature inside, particularly upstairs, was really cool.” The houses are fitted with brise soleil on the south facade.

Broadland Housing are now monitoring electricity use, as well as internal and external temperatures at both the Fulmodeston and Barney developments. Ed Mumford-Smith says most teething issues usually arise at rural developments where there's no gas network. But this isn't the case with Fulmodeston or Barney. "Usually no news is good news,” he says.

Based on their monitoring so far, Broadland may add one more electric panel heater to one of the units.

Project architect Ian Bramwell credits Andrew Fisher with the success of the building. “He was on site many days with tape in his hand going around checking for holes. Without Andy, it wouldn’t have met the passive house standard for sure,” Ian says.

Perhaps one reason for Fulmodeston's success is the alternative approach the team took to contracting. Rather than a contractor being chosen through competitive tender, the process was more collaborative: Lovell was chosen for their team and expertise, then a price was negotiated. Lovell separately interviewed its own subcontractors to gauge their ability to deliver the project.

Andrew Fisher reckons this approach is far more suited to the rigorous demands of passive house construction: he says that negotiations must take place early on, before a price has been fixed — everyone must sit down and decide what the project’s goals are and how to achieve them.

“If I was a housing association that's how I would do my business," he says. "I wouldn't put it out to tender."

Passive house doesn't need to be complicated or costly, he says, but clients must be willing to pay the true cost. Equally, subcontractors can't assume that items can be "value engineered" out, or work artificially hastened during the build.

"In my opinion we don't allow our trades enough time to do the job properly," he says. "This is why I think we have the performance gap in the UK."

At Fulmodeston, subcontractors were paid per day rather than an overall fixed price — to make sure they had the time to do their work thoroughly. Naturally, this required tight management on site.

"You need trusted subcontractors, and you need a good site team," Fisher says. "Most people actually want to get on with the work, they don't want to dilly-dally around. We never saw any evidence of time wasting."

“We had a very, very tight budget. We had to think on our feet and box a bit clever.”

Andrew says one of the big challenges for the project was the lack of a local supply chain for passive house. It was hard to find companies willing to spend on R&D at the time, he says — particularly for such a small development.

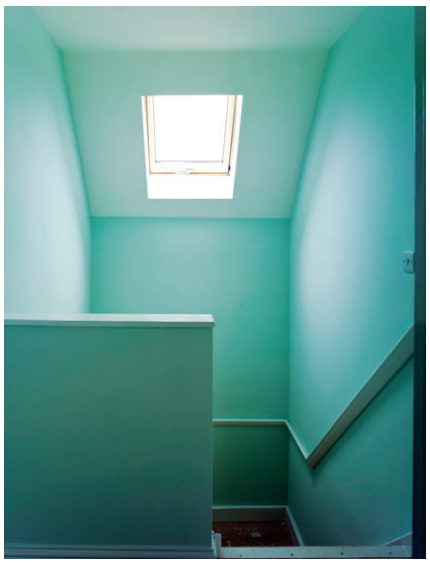
But he thinks this is changing. “The mindset is now there. The number of housing associations that are specifically requesting passive house has grown.”

“The market is seeing an interest and starting to listen and sit up. It’s interesting and encouraging at the same time.”

Broadland Housing’s Ed Mumford-Smith says that following the experience gained from the group’s first passive house scheme, they’re hoping to do more passive projects in the future, including the Carrow Road development.

"The end goal is about delivering low energy housing that people will want to live in,” he says.

SELECTED PROJECT DETAILS
Client: Broadland Housing
Architect: Mole Architects
M&E Consultant: ALH Design
Civil & structural engineer: Rossi Long
Contractor: Lovell Partnerships
Energy consultant & project management: Lovell Partnerships
Quantity surveyors: David Langdon
Mechanical contractors: J&T Plumbers
Electrical contractor: Alpha Electrical
Airtightness consultant: Lovell Partnerships
Additional wall insulation: Norfolk Drywall
Thermal breaks: Marmox
Roof insulation: Mark Group
Airtightness products: Mark Group
Windows & doors: Ecohaus Internorm
Roof lights: Fakro GB
Primary heating: Dimplex storage heaters
Ventilation: Zehnder Comfo Systems
Solar thermal: Viridian Solar ▶



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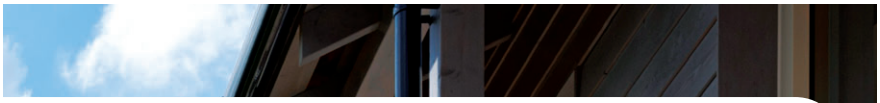
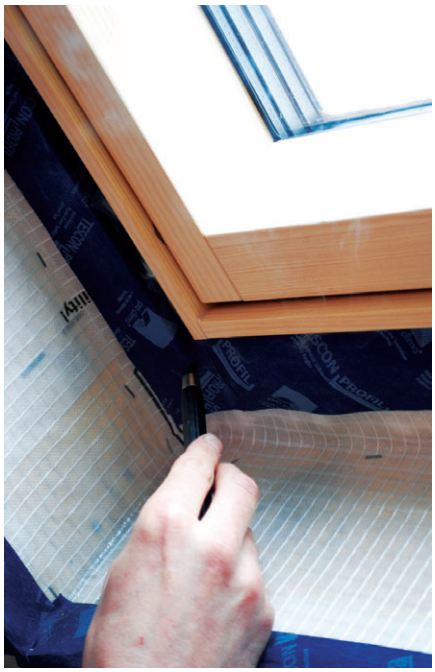


"The number of housing associations that are specifically requesting passive house has grown. The market is starting to listen and sit up."

(top) The houses are fitted with brise soleil on the south facade to prevent overheating; (bottom right) Pro Clima tapes help achieve high levels of airtightness; (bottom left) a blower door test in progress to measure the air leakages in the building; (p39) windows and doors are Internorm PHI certified triple-glazed units, and the houses also feature quadruple-glazed Fakro roof windows to illuminate stairwells



PROJECT OVERVIEW:

Building type: four unit development of semi-detached, timber frame passive houses

Location: Fulmodeston, Norfolk

Size: each unit 96 square metre approx

Completion date: July 2013

Budget: £530,000 for all four units

Passive house certification: certified

Space heating demand (PHPP): 12 kWh/m²/yr

Heat load (PHPP): 10 W/m²

Primary energy demand (PHPP): 87 kWh/m²/yr

Environmental assessment method: Code for Sustainable Homes Level 2

Airtightness (at 50 Pascals): Average of 0.6 air changes per hour

Ground floor: 65mm concrete screed with 200mm Celotex PIR insulation underneath. U-value: 0.107

Walls: 9mm OSB on the outside of the thermal envelope, followed inside by 235mm EPS bead insulation, 9mm OSB, 25mm unvented cavity, 45mm insulated service cavity, 15mm plasterboard. U-value: 0.109

Flat roof section: 500mm Knauf Earthwool Loft Roll 40 (100mm between joists, 400mm over) over uninsulated 50mm service cavity with 13mm plasterboard beneath. U-value 0.08

Sloped ceiling (north): 175mm Knauf Rafter Roll 32 insulation between the rafters, with a further 80mm of Rafter Roll over the rafters, and covered with 13mm plasterboard. U-value: 0.116 W/m²K

Sloped ceiling (south): 27mm ventilated cavity outside of 170mm rafters insulated with Knauf Rafter Roll 32, with a further 40mm of Knauf Rafter Roll 32 covering the rafters, followed inside by 25mm service cavity, 45mm Ecotherm rigid PIR insulation, 15mm plasterboard. U-value: 0.112

Windows: Internorm HF 300 Edition timber aluminium triple-glazed units, PHI certified. Average overall U-value: 0.69

Roof windows: PHI certified Fakro quadruple-glazed FTT U8 Thermo roof windows. U-value: 0.58

Heating system: 1 x Dimplex electric storage heater and 1 x towel radiator in each unit. 3 sq m Viridian Clearline V30 solar thermal panel connected to 210 litre twin immersion tank with 50/50 solar/electric volume.

Ventilation: PHI certified Zehnder ComfoAir 200 heat recovery ventilation system in each unit. 92% heat recovery efficiency

Green materials: Timber frame, recycled mineral wool insulation

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Co Down passive house built for under £200,000

As passive house moves into the mainstream, construction costs are bound to keep coming down, with increasing competition among suppliers, and designers and contractors becoming familiar with the most cost-effective routes to meeting the standard. One recent self build shows that low cost passive house needn't be a distant aspiration – it's achievable now.

Words: John Hearne

Meticulous attention to detail and a lengthy planning phase has delivered a 2,375 square foot passive house in Co Down which cost £192,000 to build. PMC Architects has published detailed costings for every element of the project, revealing just how affordable passive house can be.

"It reassures people that it can be done at a reasonable cost," says Paul McAlister of the company. He points out that the passive house premium is typically set between 10 and 15% over conventional build. (ed.- it's questionable whether passive house adds any additional cost in the Republic of Ireland, due to changes to Part L introduced in December 2011.) McAlister's passive house however cost just 8.35% more than a house built to Northern Ireland's building regulations. His figures include just £3,000 of PC sums and exclude professional and development fees.

He has compiled detailed tables which compare the house with one built to Northern Ireland's minimum standards, as calculated using the UK's Standard Assessment Procedure (Sap) 2009 software. McAlister logged each phase of the build, from foundations and ground floor construction all the way through to the installation of domestic hot water and space heating systems.

By his calculations, the total cost of the conventional Sap 2009 house comes to £175,969. That's just over £16,000 lower than the passive house cost.

In the coming year, he plans to run a detailed analysis to identify the point at which the additional measures taken to deliver the passive specification will have paid for themselves through fuel savings. "It all depends on how oil and energy prices go, but those figures will give it a different slant."

Nor is this the cheapest house that McAlister could have built. This, he says, was a high spec build. "We know we could do it cheaper if we had less sophistication. I believe we could do it for £75 a square foot if we used ordinary concrete tiles and so on. You used to hear some terrible stories about the cost of passive house, especially in the early days but I think that's now in the past."

McAlister became Northern Ireland's first certified passive house designer three years ago, but this is his first certified passive house. "There were a number of people we did designs for," says McAlister, "but the houses either didn't get built or the client didn't want to pay extra for the certified products; the windows and what have you. This was the first person who was willing to go the whole way and get it certified."

While the premium between conventional and passive continues to fall, McAlister acknowledges that delivering certified passive in a one-off residential setting still requires a highly motivated client. For the McGlinchey family who built this house, getting the energy profile of their house right was as much about doing the right thing as building a comfortable, cost-effective home.

The rural, elevated site on which they planned to build their home gave McAlister a lot of freedom when it came to orientation and layout. "We were very fortunate with the site itself in that the main view was south west facing, so immediately we were able to turn all the living spaces towards the view, and open up the glazing towards the view as well, which helped with achieving our energy rating."

The brief specified a contemporary take on a traditional aesthetic. McAlister's design takes the traditional Irish long house with pitched roof and gives it a modern feel. It includes iroko timber cladding, a porch feature at the entrance and double height space in the living room.

During the tendering process, the architect worked with one of the tendering structural insulated panel system (SIPs) companies to create working drawings for the project. But when that company didn't win the tender, a whole new set of drawings had to be drafted. The resulting delay did however give the project team the time to work though plans and iron out any potential issues.

"We stopped and said 'let's get this right before we go on.' We didn't do it on a wing and a prayer.

We took the time to get the details redrawn, then we got them certified and did the thermal bridge analysis to make sure it all worked, so we were quite rigorous in that sense."

As with all projects of this nature, the central challenge for the architects lay in designing away the cold bridges. Because PMC want to build in-house expertise in this area, they did all of the calculations themselves, then forwarded the plans to the Passive House Academy in Wicklow for verification.

The team also used the passive house software, PHPP as a design tool, working through every nuance of the plan to ensure that they remained within passive house criteria.

McAlister explains that the structurally insulated panels (Sips) were selected as a building method because in the first place, the client expressed a preference for using timber in the build. "We liked the Sip panels because they're injected with insulation in the factory and for that reason we did not have to rely on onsite workmanship to the same degree. The house is a storey and a half with Sip panels on the roof as well, so we had a nice neat envelope. I liked it because I knew that it would perform."

The passive tailored Sips – supplied by Warrenpoint-based manufacturer Sipfit – are the single greatest cost item in the spec, and the element of the build which commanded the highest premium over the equivalent conventional spec. According to McAlister's tables, the passive SIP frame cost a total of £56,000. By comparison, the SAP 2009 construction, which is also a SIP frame – albeit with substantially less insulation – cost £44,800, a difference of £11,200.

Photos: Simon Mills

"There was a lot of work with the airtightness. Classic example: The plasterers nailed a three inch nail through the membrane to hang their radio. You're just trying to teach old dogs you can't do this."

Using Sips, in addition to providing factory fitted insulation, also facilitates eliminating cold bridges, because the system creates a continuous thermal envelope through walls and roof.

Primary responsibility for airtightness lay with contractor Kevin Mulligan of Baylands Construction. "There was a lot of work with the airtightness," he says. "A lot of attention to detail and trying to get my subcontractors used to how you have to work around an airtightness membrane. Classic example: The plasterers nailed a three inch nail through the membrane to hang their radio. You're just trying to teach old dogs you can't do this, you have to try to get electricians and plumbers up to speed; you just can't willy-nilly drill holes anywhere you want, you have to plan where you're going to put your cable and pipe routes." ▶

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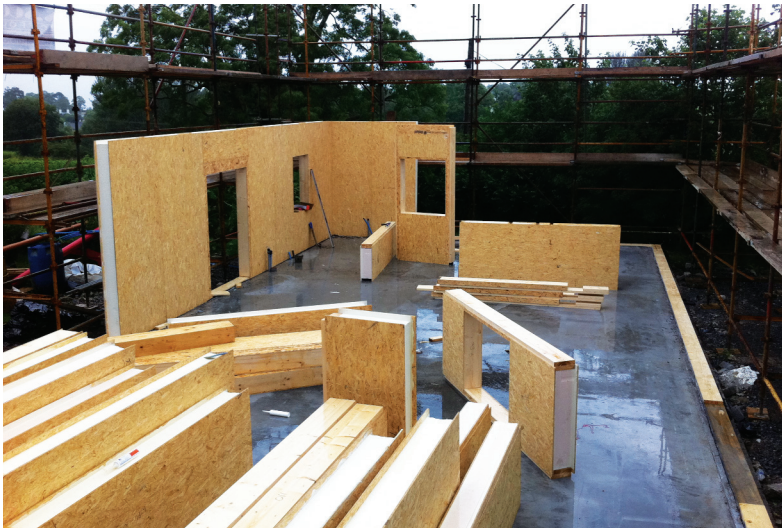

(above) Erection of the structural insulated panel system, which facilitates eliminating cold bridges, because the system creates a continuous thermal envelope through walls and roof; (bottom right) a triple-glazed Velux roof window allows extra light into the house; (bottom left) the steel web floor joists house building services such as MVHR ductwork discretely

Like Paul McAlister, this was Baylands' first passive house, and inevitably, the project brought the team up a steep learning curve. Through repeated airtightness tests, Mulligan achieved successively lower airtightness results until he finally broke through the magic 0.6 ACH.

McAlister also cites choosing a heating system as another challenging aspect of the job.

"It was designed to require 14 kWh/m²/yr. This meant it wasn't a low enough heat load to be carried through the ventilation system so we needed some sort of heat source. The calculations showed that the maximum steady state heat loss was three kilowatts when it was minus ten outside, so we knew that we had to provide a heat source that worst case scenario would provide three kilowatts."

A room-sealed wood burning stove in the living room provides approximately the required three kilowatts, but a back-up heat source was still needed. McAlister's first solution was to install a small underfloor heating system connected to an air source heat pump, but because the capital cost of the underfloor heating came in close to £7,000, the budget wouldn't allow it. "In the end, we decided to install direct electric radiators. They're not in yet, but instead of costing £7,000, they cost £500. We have six kilowatts of direct electric which we hope we never need. But they'll be there there if we do."

A heat pump was nonetheless installed – an exhaust air heat pump, which forms part of an integrated heating, ventilation and hot water solution, heating towel rails in the home's two en suite bathrooms and contributing to domestic hot water supply. The heat pump has controls in place to source the warmest air at any given time – whether from external air, from the extract from the MVHR system, or from the ventilated loft in the summer. How water is provided primarily by four square metres of solar thermal panels feeding into a 300 litre domestic hot water cylinder. According to renewable heating provider Solmatix, the solar will generate free hot water for six to eight months of the year with the heat pump taking over during the winter to provide cheap hot water.

The McGlinchey's have now been in the house since May – with the house wired for direct electric radiators that haven't yet been installed – and so far, so good.

"There's going to be a bit of a learning curve," says Paul McAlister. "but they're really pleased. What we really need now is to see how it performs in the winter…"

SELECTED PROJECT DETAILS
Architect: Paul McAlister Architects
Passive house certification: Passive House Academy
Main contractor: Baylands Construction
Airtightness tester: Airtightness Ireland
Build system supplier: Sipfit
Additional wall & roof insulation: Rockwool
Floor insulation: Kingspan Springvale
Thermal blocks: Foamglas
Airtightness products: Pro Clima/Vario
Windows & doors: Munster Joinery
Roof lights: Velux
Zinc /aluminium cladding: Rowan Roofing Company
Steel web floor joists: Haldane Fisher
Heat recovery ventilation: Pure Renewable Energy
Renewable heating system: Solmatix Renewables
Stove: All Fired Up Stoves ▶

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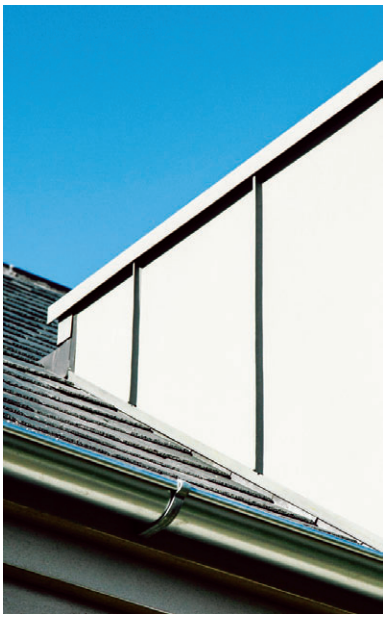

PROJECT OVERVIEW:

Building type: 185 sq m detached two-storey passive house

Location: Bangor, Northern Ireland

Completion date: April, 2013

Budget: £192,000

Passive house certification: certified

Space heating demand: 14 kWh/m²/yr

Heat load: 11 W/m²

Primary energy demand: 91 kWh/m²/yr total demand on heating installation, domestic hot water, household electricity and auxiliary electricity calculated according to PHPP.

Airtightness (at 50 Pascals): 0.6 ACH

Energy performance certificate (EPC): A-92

Thermal bridging: first two courses of Foam-glas Perinsul SL, thermally broken window frames, insulated reveals.

Ground floor: solid slab. 100mm screed; 200mm Springvale Platinum EPS; 150mm concrete sub floor. U-value: 0.144

First floor: contains Posi-Joist open web floor system to house building services including ventilation ductwork.

Walls: Sip panels. 20mm render, cement and sand; 100mm concrete block outer leaf; 50mm unventilated air layer; 1mm breather membrane; 12mm oriented strand board (OSB); 200mm polyurethane insulation; 12mm OSB; 1mm Pro Clima DA airtightness membrane; insulated service cavity; 13mm plasterboard. U-value: 0.11

Roof: natural slates externally on 50x35mm battens/counter battens; 1mm Juta Trim Easy breathable roofing underlay; 12mm OSB; 200mm polyurethane insulation; 12mm OSB; 1mm Pro Clima DA airtightness membrane; insulated service cavity; 13mm plasterboard. U-value: 0.11

Windows: triple-glazed Munster Joinery Passiv Future Proof PVC windows, with argon filling. Overall U-value: 0.78

Roof windows: triple glazed Velux roof window with a recessed flashing kit. U-value: 0.82

Heating & hot water: 4kW Rika Vitra Passive House wood log burning stove, room sealed. Back up space heating to towel rails and domestic hot water is provided by a Solmatix X3 Combi air source heat pump with a COP of 3.68, based on EN 14511-2, with controls to prioritise take air supply from external, MVHR extract, or ventilated loft subject to air temperature. 300 l domestic hot water cylinder. 4 sq m Solmatix solar thermal array to provide domestic hot water in conjunction with heat pump.

Ventilation: Paul Novus 300 heat recovery ventilation system — Passive House Institute certified to have heat recovery rate of 93%

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Passive architect

The window company who came to fit out architect Helena Fitzgerald's passive house in Carlow had allowed five days for the job. Such was the precision with which the frame had been planned however that they only needed a day and a half.

Donal Mullins of Shoalwater Timberframe says that the levels of accuracy in the frame were unbelievable. "Helena had worked everything out to the millimetre," he says. "All that accuracy in design spills through for everyone so that the build goes really smoothly. Everything was done on paper beforehand and that's the way it should be done. There were no meetings on site with the usual head scratching; 'how are we going to get around this one? Whose fault is this?' She was a pleasure to work with."

Helena cut her teeth working with Building Design Partnership (BDP) in Scotland, before returning home to Carlow in 2005. Four years later, she set out to build a passive house for herself and her young family.

"My husband and I understood that this was the biggest project we were ever going to get involved in and that it had to reflect our values," says Helena. "My husband was really supportive about trying to develop our own project as a passive house."

Built on her family's farmland, the site on which Helena planned her house provided spectacular views of Mount Leinster and the Blackstairs mountains, and featured a mature oak tree. The problem however was that these were found to the east and west of the site respectively. Passive design seeks to make the most of solar gains by maximising glazing on the southern elevation.

Making the most of the site's natural features while maintaining the passive approach was a challenge which Helena relished. "Many of the passive houses I had seen appeared quite scientific in their approach," she says. "They

walks the walk with Carlow home

None of the editorial team behind Passive House Plus has the good fortune to live in a passive house – at least not yet – meaning our promotion of passive house comes with more than a hint of "Do as I say, not as I do". That's emphatically not the case with certified passive house designer Helena Fitzgerald, who chose to practice what she preaches with her own home, to stunning effect.

Words: John Hearne

weren't very expressive forms, their architectural quality wouldn't appear to have been a priority. If passive house is to be applied more generally, you need to be able to use it on all sites, not just the ones which have the south facing aspect to the rear. I was really interested to see how flexible it could be."

Acutely aware of the 'privilege' of building on a green field site, she wasn't solely concerned with the energy profile of the house. In addition to the mountain view and the mature oak, the site also featured an old granite dry stone wall and a slight dip in the ground to the south east corner. Helena was keen that the design should respond to these features. "The other preoccupation was land use. We live in the countryside and we have a relatively large site; it's in excess of half an acre and we didn't want to be mowing the lawn all the time. We wanted to think about how we were going to be using this piece of land."

In coming up with a design, Helena divided into four distinct areas: a public/arrival area to the north east and a functional/working garden for wood storage and clothes drying to the south west, with a raised bed percolation area providing shelter for the kitchen garden. The kitchen/dining area opens onto a leisure garden to the south east, which includes the only area of conventional lawn. In the final quarter to the north east, she had planned a wilderness garden, though this is now under review because the soil type doesn't appear appropriate.

To make the most of the key features to the east and west, the living areas were given an east/west orientation with informal kitchen, dining and family room to the south. Services went into the northwest corner, with utility and entrance, neatly facilitating a division between the public arrival space from the more intimate kitchen garden. "We decided not to ▶

Photos: Ros Kavanagh

have a garage because people don't use garages, they just need a space to store bikes and stuff," says Helena. "This meant that we ended up with an L shaped plan...Having this L shape meant we could have the longer elevation to the south, which was critical in terms of getting enough southern light into the building."

The deployment of glazing has of course a significant impact on the performance of the house. Helena here was guided by how each room was used. In the kitchen/dining area, which opens onto the recreational garden and faces south, the windows go right down to floor level. In the more formal areas east and west, smaller 'picture' windows capture specific views. "If we put smaller windows in east and west, we would have had a better thermal performance for sure, but the amenity value of the views would not have been the same. There was a trade-off there."

Here again is a reaction against the notion that passive must be hamstrung by the science. Strict interpretation of the guidelines would leave northern elevations almost blank, with extensive glazing to the south. A more liberal interpretation allowed Helena a more expressive building, though this meant that she had to find ways of compensating for any resulting heat losses in other ways. She points out too that that you can increase glazing while minimising heat loss. It's the frame that tends to let the window's energy performance down. "If you have lots of divisions, your window is going to perform less well than if you have larger panes of glass. That's taken to the ultimate in the master bedroom window, which is just a huge fixed pane of glass with no openings."

While the budget did not stretch to passive certified windows – the options Helena looked at commanded a considerable premium over non-certified ones available at the time – she says the Kneer-Sued-fenster triple-glazed units still achieve close to passive standards.

When it came to choosing materials and a building method, Helena was keen to maintain the sustainable philosophy she brought to the rest of the project. She learned about Siberian larch cladding from BDP colleagues who had used this material on the Isle of Skye, off the northwest coast of Scotland. The timber is untreated, and has a rough, organic appearance. Not only does it respond well to the existing tree on the site, it also weathers to a pinky grey colour, very similar to the existing granite wall. "In five years time, I think this building will be almost invisible from the road," says Helena. "It will disappear."

The combination of Supergrund foundation and cellulose-filled timber frame construction delivers an envelope befitting of a passive house. Thermal bridge free construction – an essential part of passive house design – was achieved through the use of a continuous insulation layer which wraps the entire building. Helena trained in thermal modelling and produced all the construction details herself. Shortly after she had completed the work however, the National Standards Authority of Ireland introduced a registration scheme for thermal modelling. Helena found registration an expensive process, and decided that commissioning new thermal bridge details from a registered modeller was both unnecessary and beyond the reach of the budget. The result is that for Deap purposes, Helena has had to use a set of default details which drastically misrepresent how thermal bridges are circumvented in the house, leaving her with a poorer BER certificate.

Airtightness was achieved primarily through the use of OSB board, taped using Intello products. Donal Mullins of Shoalwater, who took responsibility for this element of the build, says that he was initially nervous about using OSB as an airtight layer.

"This was a challenge because OSB isn't a certified board for airtightness," he says, "but I knew that detailing the project properly and dealing with all the crucial areas would limit that risk. We had to think outside the box with the airtightness, but it did pay dividends in the end with the final reading we got."

Gavin O'Sé, who conducted the airtightness tests and carried out the BER assessment, reports a final test air change rate of 0.38, an excellent result, well inside the passive house threshold of 0.6 ACH.

Solar thermal panels provide the bulk of domestic hot water needs. Helena considered two options for space heating and domestic hot water backup. "We couldn't imagine a living area without a flame so a room-sealed stove was included in both options. The first was an air to water heat pump with a room heating stove, the second was a stove with back boiler." Because of budget restrictions and the fact that the heat demand was so low, Helena didn't want to duplicate the systems, so she opted for the latter. This option, while it did suit the family's lifestyle, did however have an impact on the final BER, owing to the lack of heating regions or thermostatic control. "Stoves are inherently manually operated," she says. "We were penalised for this in the BER process due to the lack of thermostatic control."

As for fuel usage, Helena has an abundant biomass supply that comes from maintaining hedgerows on the family farm – a supply that far ourstrips demand. "We stopped lighting the stove in April," she says. "We've lit it twice so far this winter, but mostly because we had people staying who wanted to see it in action." ▶

(clockwise from top left) It's a tight squeeze up a narrow road as the factory-built timber frame is delivered to site; a combination of OSB, tapes and membranes form the airtightness strategy; the cellulose insulation being installed to provide a continuous, cold bridge-free layer of insulation

Electricity costs are working out at approximately €95 per month – the only actual energy cost at the moment.

Helena also decided not to go for passive house certification – which would have added a cost of circa €1500 – due again to budget considerations. "I have another project pending certification, so I didn't really need to do it for my work. I would have liked to do it on this project but we needed to put a kitchen in."

The family moved in March 2012, during the cold snap, when temperatures outside rarely got above freezing during the day. "It was very comfortable," says Helena. "If there's any sun at all when it's cold, you're toasty.

"You could be very critical of the house, you could say that it is not the most economic way of achieving passive house but it is a very particular site and I had to respond to that. If I had just put a rectangular block here, it would have been a missed opportunity. I wanted to ask, can you achieve this energy performance with a more expressive and architectural form? If passive buildings don't respond well to their setting, will people want them? Or is it going to be something that's just peripheral fascination of a few, motivated individuals?"

SELECTED PROJECT DETAILS
Architects: Helena Fitzgerald Architects
Executive architect: Kelliher Miller Architects
Structural engineer: ONCE Civil & Structural Ltd
BER assessor and airtightness tester: Greenbuild
Mechanical contractor: Michael Wall
Electrical contractor: Doyle Bros Electrical
Timber frame: Shoalwater Timberframe
Cellulose insulation: Isocell Ltd
Mineral wool insulation: Isover Ireland
Wood fibre insulation & airtightness systems: Ecological Building Systems Limited
OSB: Smartply
PIR insulation: Xtratherm
Floor insulation: Kingspan Aerobord
Additional airtightness tapes: Tremco Illbruck Ltd
Windows and doors: Kneer-Südfenster
Steel frame for brise soleil: Murtech Engineering Ltd
Screeds: Dan Morrissey IRL Lrd
GGBS for screeds: Ecocem
Stove: Olsberg
Solar thermal: Kingspan Solar via Polytherm
Underfloor heating: Polytherm
Heat recovery ventilation: Pure Renewable Energy Ltd
Lighting: Mid West Lighting/Habitat/Mawa Design
Water conserving fittings: Hansgrohe
Sanitaryware: Duravit/Bette
Fit-out joinery: James Hanrahan Carpentry
Engineered oak flooring: Wogan Distributors via Heiton Buckley
Coir mat entrance carpet: Footfall
Roofing membrane: Laydex Ltd.

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This content is exclusively available to our digital subscribers.

PROJECT OVERVIEW:

Building type: 233 square metre detached two-storey timber frame house with a 14 sqm shed

Location: Borris, Co Carlow, Ireland

Completion date: March 2013

Budget: not disclosed

Passive house certification: not certified

Space heating demand (PHPP): 14.9 kWh/m²/yr

Heat load (PHPP): 11 W/m²

Primary energy demand (PHPP): 92kWh/m²/yr

Airtightness: 0.3875 ACH / 0.418 m³/hr/m². (An50 result of 0.6 would have made the building fail to reach the passive house standard as the space heat demand would have risen to 15.8 kWh/m²yr)

BER: B1 (78.47 kWh/m²/yr)

Thermal bridging: The structure was designed to be thermal bridge free, as required for a passive house, with a continuous layer of insulation around the perimeter of the building envelope. Specifically, an insulated raft foundation was used, 50mm wood fibre board was fixed to the external face of timber frame walls and PIR insulation used on top of the roof deck. Care was taken to ensure continuity of these layers at the substructure/superstructure junction and where the wall meets the roof. At window openings, timber framed windows were used; externally, wood fibre board insulation overlapped the windows by a minimum of 50mm and internally the reveals were insulated. In Deap The Y factor value used for thermal bridging was set to a default level as full calculations were deemed too costly.

Ground floor: Supergrund insulated raft foundation system with 300mm EPS. U-value 0.113

Walls: Factory-built timber frame with 25mm untreated Douglas Fir cladding externally in board on board format, followed inside by treated softwood battens and counter-battens, Pro Clima Soltex WA breather membrane, 50mm Gutex Ultratherm woodfibre board, 222 x 44mm Isocell cellulose-filled timber stud, 18mm taped and sealed OSB3, 50mm service cavity insulated with Isover Metac insulation, and 12.5mm Fermacell board internally. U-value: 0.129

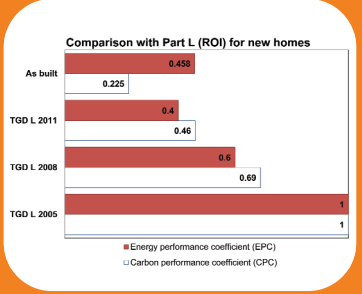
Roof: 60mm pebbles on Alkorplan membrane build-up on 100mm Xtratherm FR MG insulation on Alkorplus vapour control layer on 18mm OSB3 structural deck (part of timberframe) on 225 x 44mm rafters filled with 220mm Metac insulation, Pro Clima Intello vapour control layer, 35 mm uninsulated service cavity, 12.5mm plasterboard ceiling. U-value: 0.104

Windows: Kneer-Süd-fenster HF90 1000 triple-glazed spruce windows, with argon filling. Overall U-value: 0.83

Heating system: 80.5% efficient Olsberg Tolima Aqua Compact stove with back boiler, plus 40 Kingspan Thermomax Varisol DF100 tubes, supplying 200L DHW cylinder, and 400L buffer tank supplying underfloor heating and towel radiators in upstairs bathrooms.

Ventilation: Paul Novus 300 heat recovery ventilation system — Passive House Institute certified to have heat recovery rate of 93% and electric efficiency 0.24 Wh/m³.

Green materials: Fermacell, cellulose insulation, untreated douglas fir cladding.



Irish whiskey distillery

puts fabric first

Passive house is all about using tiny amounts of energy to deliver maximum comfort for those living and working in buildings that meet the standard. So why did Wain Morehead Architects turn to their passive house knowhow when designing a whiskey distillery that won't have any occupants?

Words: Lenny Antonelli

At its heart, the passive house concept is about comfort. Sure it's about saving energy and cutting CO_2 emissions, but you'll find a committed few achieving those goals by turning the heat off and sticking on a heavy jumper. The difference with passive house is that it achieves these goals while providing a warm, healthy indoor environment.

So what's the point of using passive house principles when designing a building that won't have any occupants?

The new Irish Distillers Garden Still House building at the company's Midleton distillery never aimed to reach what some consider an onerous low energy standard. But its designers Wain Morehead Architects found that applying 'fabric first' passive house principles served the unique demands of distillery design. Irish Distillers — a subsidiary of French multinational Pernod Ricard — produces Jameson, Paddy, Powers and other Irish whiskeys.

"We were able to use all the tools and techniques we used from doing passive house buildings and apply it to this building," says architect John Morehead.

First, airtightness means the facility can contain any alcohol fumes and expel them through a designed ventilation system and diffuse them — rather than have them exit at random through gaps in the building envelope. This is important for protecting the building structure, as alcohol vapours encourage the growth of certain moulds and can pose a major fire risk.

Distillation operates in high temperatures and still buildings can become very humid at times, so preventing condensation — either on the internal surfaces or interstitially — was also key. Eliminating cold spots through good insulation, airtightness and a design free of thermal bridging helped achieve this.

"If you didn't have good levels of insulation and vapour control you could end up with condensation in the envelope," John says. "We didn't want to be constructing a building that was going to fail in 40 years — that would have been a huge reason for getting those levels for insulation. We also wished to maintain adequate temperatures during shutdown to reduce process and sprinkler pipework insulation requirements."

The metal-stud opaque walls are insulated to a U-value of 0.16 with Rockwool Flexi. They're clad externally with Tegral Natura Pro rain screen on a breather membrane and Durapanel weather layer, and internally taped and sealed with Tegral Hydropanel.

“If you didn’t have good levels of insulation and vapour control you could end up with condensation in the envelope”

The roof is insulated to a U-value of 0.15 with 140mm of Kingspan Thermaroof PIR insulation and 60mm Rockwool in the troughs, and also includes a Soprema vapour control layer. The ground floor slab is insulated with 150mm of Kingspan Styrozone XPS insulation.

The airtightness target on the project was one air changes per hour, though no blower door test was done.

“There’s no reason why we shouldn’t have well exceeded it, because the construction is actually quite simple with not too many connections,” John says.

Besides protecting the structure, there’s another reason the design team wanted to prevent condensation — to protect the building’s good looks. The glazed facade that shows off the huge pot stills forms an architectural centrepiece at the distillery, and would be fairly ineffective if it fogged up.

Counter-intuitively for passive house designers, this glazed wall faces north. Distillation produces such big internal heat gains that orientating the building south to capture solar energy wasn’t necessary and the radiant asymmetry created by the cold surface could incite air movement.

Designed by Billings Design Associates and supplied by Alucraft , the double-glazed curtain wall has a U-value of 1.6Wm^{2}K. One of the huge glazed sections in the gables can be opened to facilitate plant access.

The transparency and clarity of the glazing was key. This facade includes frameless vertical joints, glass-to-glass corners and uses a white glass that’s low in iron.

The double-glazed roof lights are removable too — the pot stills were actually lowered through them during construction.

The south-facade features a Tegral SolarWall air heating system. This consists of a dark sheet of perforated, heat-absorbing sheet metal. As air passes through the perforations it is warmed up by the wall. Once warm air reaches the cavity behind, it rises to the top of the building. If heating is ever needed — such as for frost protection when the facility is shut down over Christmas — this warm air can be distributed using electric fans. If it isn’t needed it’s simply vented out of the building. The SolarWall system can produce 75,000kWh of heat annually, while the thermal mass of the 800 square metres of exposed concrete inside helps to regulate internal temperatures.

Perhaps the crowning achievement of the building is that its huge ventilation demand is met passively. By ensuring the temperature inside is always kept at least 5C higher than outside, a passive stack is created: warm air rises up through vents in the roof, creating a chimney effect that pulls fresh outdoor air through vents in the floor. According to John Morehead, the ability to maintain a 5C temperature difference ensures the system will manage to exchange 5.61 cubic metres of air every second.

For building services engineer Mark Ryan of the PM Group (who were also contractors on the project), the very fact that the design team considered natural ventilation makes this project unique. “Most industrial plants I’m involved in wouldn’t even ask the question, they’d just put the fan in,” he says.

The project is partly inspired by old distilleries that pioneered the use of passive stack ventilation. Mark says the most common problem with passive stack is that it can work too well, creating huge draughts. Here, closing some of the dampers in winter — when the temperature difference between inside and outside is greatest and the stack effect strongest — will help control this.

“If you have poor building envelope performance it will impact on the stack effect significantly,” John Morehead adds.

Besides the building itself, Irish Distillers has drastically improved the efficiency of its own distillation with the latest technologies.

Its updated distillation process is able to extract 99% pure alcohol from raw material as opposed to 92% before. Maize cooking is also much more efficient now, and the new pot stills recycle heat over and over to maximise efficiency. In fact, the operational energy ▶

(clockwise from top left) An early 3D image of the building; Rockwool insulation being applied to the walls; installation of the double-glazed curtain wall; the structural elements to the primary steel are isolated from the interior environment by thermally broken Isokorb connectors; (p59) (top left) the walls are clad externally with Tegral Natura Pro rainscreen, and the south facade also features a Tegral SolarWall heating sytem (top right); the SolarWall is perforated to allow air to pass through, and in doing so is heated by the wall's warmth

requirement at the facility is 1.5kwH per litre of alcohol, compared to from 2.56 previously.

"Sustainability was a pre-requisite from the outset, from the design stage. Every element of design was examined from a sustainability perspective," says Tommy Keane, head of distilling operations at Irish Distillers. Because new equipment is expected to last 30 years, Keane said it was imperative to install the latest, most energy efficient plant.

"I had looked at some passive buildings, and I know that John [Morehead] is pretty passionate about it. We had a few chats just to air a few ideas, and eventually we sort of ran with it," Tommy says.

"We've effectively reduced the energy consumption by about 50% compared to the original plant."

This doesn't just apply to the new building though — the company has installed the most modern equipment throughout the distillery.

Besides the impressive energy achievements, Irish Distillers now has a striking contemporary structure to show off modern distillation and sit alongside the 18th century buildings on site.

Within 11 months of work starting on site, the first alcohol had been produced. Three pot stills are now in operation at the building, and three more are currently being manufactured to sit alongside them.

"We wanted a signature building to show off what are effectively the largest pot stills operating in the world," Tommy says.

Architect's statement — John Morehead, Wain Morehead Architects

The Garden Stillhouse building is located within the Midleton distillery complex. It is an Atex rated building and is within a Seveso site. The restrictions on the use of components and materials is therefore heavily monitored to onerous health and safety standards. As alcohol fumes are heavier than air, their effective displacement had to be addressed at an early design stage.

FM Global, the insurers, had an active role in authorising the use of approved construction methods at the early design stage and issuing project specific guidelines and performance targets. Time was of the essence as this building played a key role in the major expansion and energy reduction programme embarked upon at the home of Jameson.

Apart from having process requirements the new still house has to be a signature building and to compliment the 18th century buildings already found in the distillery grounds. The stills are the focal point of the process form and had to be clearly visible from outside. The north facing, raked glass wall is constructed so as to minimise reflection and increase visibility of the stills within. The cool surface of the glass causes rapid cooling and inversion of the warmed air as it comes in contact. The U-value of this low iron white glass double-glazed system curtain wall system is 1.6.

The built result is considered to be somewhere between a process building and a cathedral.

The building footprint is 960 sq m. The lower ground floor houses a significant amount of plant which is hardly evident when viewed externally. The upper floor of the building houses the large copper pot stills, based on a pattern for the original Jameson stills which incidentally, are the largest stills in Europe.

This 10m high hall has a central concrete walkway with the stills located either side in a ventilated floor zone. The grated flooring allows fresh air from the lower ground floor to circulate through the building and vent through slots in the apex of the skylights over. The skylights themselves are 7.6m x 7.6m in area and removable to facilitate replacement or renewal of the individual pot stills. The form of the roof-lights also provides a significant amount of solar gain to maintain temperatures during the shutdown period.

The stack effect moves 20,200m^3/h of air without any additional mechanical support. The building is designed with future expansion in mind: there is a provision for three more stills which will increase capacity from 33 million litres of pure alcohol per year in 2011 to 64 million litres following the works. Internal linings were kept flush to reduce dust accumulation and aid effective flow.

The building envelope is designed to a very high level of thermal performance with U-values of 0.16 for the walls and 0.15 for the roof areas. The omission of thermal bridges and condensation risk was carried out using Therm and Psi-Therm tools. Resilience and longevity were of paramount importance as maintenance scheduling is predetermined. The selection of external rain-screen materials and cladding systems reflected their aesthetic and resilience in a distillery environment.

The addition of Solarwall cladding system to the south of the building, provided additional capacity of 76,700 kWh/yr of preheated air. This wall has minor perforations which allow sunlight to warm the airspace behind the panel. This warm air is collected in a plenum and is then ducted into the building to assist in the heating of the space during times of building shutdown. The thermal mass of the lower floor area is significant with 800m^3 of concrete within the thermal envelope as a heat sink, again for shutdown. Having this latent heat available permits the installation of non-insulated sprinkler systems, reducing costs and aiding leak detection and maintenance.

SELECTED PROJECT DETAILS
Client: Irish Distillers / Pernod Richard
Architect: Wain Morehead Architects
Contractor & project management: PM Group
Civil, structural, mechanical engineering: PM Group ▶

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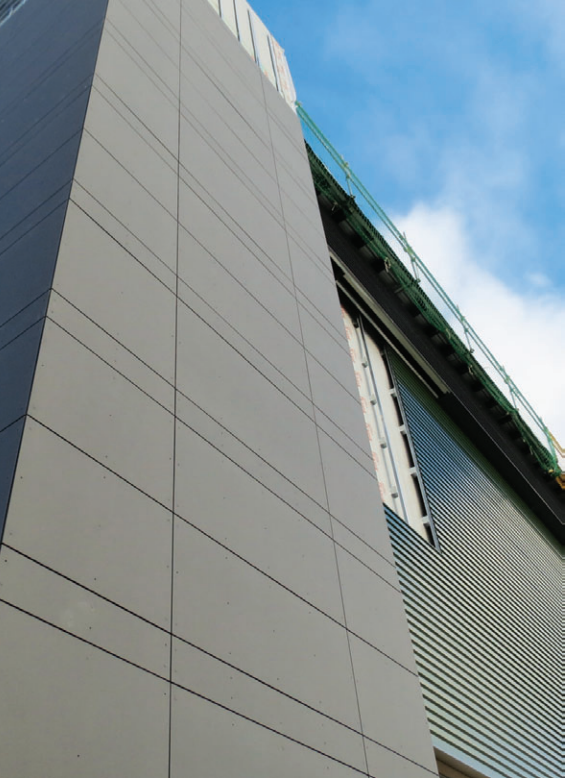

Planning consultant: McCutcheon Mulcahy
Facade specialist: Billings Design Associates
Fire consultant: Cantwell, Keogh & Associates
Landscape consultant: Forestbird Design

Ground works: PJ Hegarty
Envelope contractor: Alucraft
Structural steel: Cronin Buckley
Roofing contractor: MultiRoofing Systems

Glazing consultants: Nazeing Glassworks
Sprinkler system: Writech
Solar wall & cladding: Tegral
Solar wall design: CA Group
Isokorb thermal breaks: Contech Accessories
Basalt wall ties: Longs
Aluminium louvres & brise soleil: QEF Ltd
Aluminium doors: AMS
Roof membrane: Soprema Ireland
Insulation: Kingspan/Rockwool

PROJECT OVERVIEW:

Building type: steel-frame distillery production building. 960 sq m footprint, 21.5m high (to apex of roof-lights). The main access from the garden is via a bridge to an intermediate level. Access is restricted due to the nature of the process. The retention of existing hedgerows and features has retained the garden setting for this unique building.

Location: Midleton, Co Cork

Completion date: first base spirit produced in march 2013, practical completion achieved in August 2013

Cost: €3.6m (€3,750 per square metre)

Passive house certification: not sought

Airtightness: A full air leakage test has not been carried out but the building was designed to achieve 1 ACH. The nature of the process and concerns regarding alcohol vapours and their volatile nature was complimentary to ensuring that the overall envelope retained airtight and vapour control throughout.

BER: Not required

Thermal bridging: In order to limit thermal bridging a number of methods were adopted.
1. The wall construction generally is a 'built up wall system which is fitted with an external boarding material – (Duripanel) fitted to 95mm crossrails packed with Rockwool batts. Cross rails are fitted to 175mm vertical rails packed with Rockwool batts. Internally a boarding material – (Hydropanel) is fitted to the vertical rails – joints are filled and sealed to be airtight. This boarding acts as the vapour control and airtight layer. The boarding is faced internally with a self-finished lightweight trapezoidal liner sheet. Externally there are a number of differing finishes.
2. There is an overhang roof element which is insulated to top, leading edge and underside. The structural elements to the primary steel are isolated from the interior environment by Isokorb units.
3. Cavity based masonry construction to the lower ground plinth makes use of high performance 'basalt' wall ties to limit thermal bridging.
4. Underside of slabs insulated and the face of foundations are insulated to the underside of the built up wall construction to maintain a complete thermal envelope.

Ground floor: Resin flooring, on 300mm concrete slab (power float finish), on DPM, on 150mm Kingspan Styrozone N300R. U-value: 0.15 W/m^{2}K

Walls: The wall systems are of built up metal stud/counter stud fully insulated systems with cementituous boards of differing vapour permeability and densities to suit their location. They are generally lined with an internal profiled metal liner. An external rainscreen of fibre cement boards or profiled metal sheeting completed the construction.

Rain-screen walls: 8mm Tegral Natura Pro rainscreen cladding (N251 Anthracite) on 40mm Tegral vertical rails, on Tyvek UV façade breather membrane, on 12mm Tegral Duripanel, on 90mm + 145mm sheeting rails full filled with Rockwool Flexi insulation, on12mm Tegral Hydropanel taped & sealed to form vapour check, on 33mm Tegral C33 liner sheets. U-value: 0.16

Roof: mechanically fixed Flagon SR membrane, on 140mm Kingspan Thermaroof TR26, on 1mm Sorprema vapour control Layer, on Rockwool (trapezoidal infill pieces to troughs – nominal 60mm), on profiled metal deck – (Tegral Building Products) – thickness 1.0mm (profile 50mm deep), metal liner sheet (1mm) to perimeter. U-value: 0.15.

Glazing: double-glazed low-iron white glass curtain wall system. U-value: 1.6

Heating system: There is no traditional heating system provided in this facility. The building houses presently 3 of the 6 copper pot stills. These large stills, radiate significant heat during the process which is removed using the stack effect cooling.

Ventilation: passive stack ventilation system.

Want to know more?

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DUBLIN 4 HOME

reborn with Enerphit upgrade

Photos: Matteo Tuniz

While the passive house standard is long established in Ireland and the UK, the comparatively new equivalent for retrofits, Enerphit, is still in its infancy. In spite of a dauntingly complex and crumbling existing building, a detached house in Donnybrook has been modernised to become Ireland's 2nd certified Enerphit building.

Words: John Hearne

If this project proves nothing else, it's that passive standards can be achieved in the most unlikely situations. The decision to go for Enerphit didn't come until after planning permission had been granted. This put serious limitations on the amount of reworking that could be done in order to achieve the higher thermal performance. In addition, the client had set out precise specifications for the internal layout of the house which were non-negotiable. There were the inevitable budgetary restrictions and with the south side of the house facing onto the street, even the orientation was wrong. Add to that the normal challenges of deep retrofit, this Dublin suburban Enerphit project represents a remarkable achievement for both the design and construction teams.

"The client has a large family and very specific design requirements," says Archie O'Donnell of Integrated Energy, who was energy consultant on the project. "They wanted open plan living, they wanted lots of light and they wanted to open up the garden." Because the existing house fell far short of what was required, demolition would have been the first choice, but planning restrictions required an element of retention on the project.

"It was only really during the detailed design stage when we were putting together the tender documents that the client decided to aim for the Enerphit standard," says architect Alan Burns of Bright Design Architects. "Obviously, it would have been a lot better if this decision had come pre planning. With the south facing orientation on the streetscape, we would have redesigned the facade both on the south and the north to reflect this, and we would have included a bit more shading. Also, we had set certain window sizes and configurations and did not have the option to change them."

It was design with one arm tied behind your back. And the biggest challenge, everyone knew, would be airtightness. The house had been extended many times over the years, which meant that there were a variety of wall types, including nine inch hollow block and cavity wall, with some brick faced fronts. There were particular concerns about air infiltration in the rising walls.

Though the client would have liked to retain some of the internal walls and existing timber floor, he conceded that these would have to be removed in order to facilitate the airtightness strategy.

Even at that, it was felt at tender stage that while all other Enerphit criteria could be met, the air change rate of 1 ACH would be a bridge too far. For that reason, the tender documents specified a slightly higher air change rate in order to protect the budget. Cyril Mannion of Passive House Builders won the tender, and though he had no contractual obligation, he nonetheless committed to achieving the Enerphit airtightness standard at the existing budget.

Archie O'Donnell says that at the beginning, the plan was to retain as much of the existing building as possible. "That would have included all of the outer four walls and the first floor timbers, but on investigation it was found that because of extensions over the years and because of the use of a lot of hollow block, the rear wall was in a bad state and couldn't be retained. On top of that, the timber joists were damaged at the end grain, and they had to be replaced." ▶

(above) The clients wanted a bright spacious open plan design, as evident by this photo of the main living area, which opens up to the garden (below) through the large glazed areas that allow plenty of light into the house; (p65, main picture) bespoke roof windows introduce additional heat and light into the core of the house, down through the stairwell

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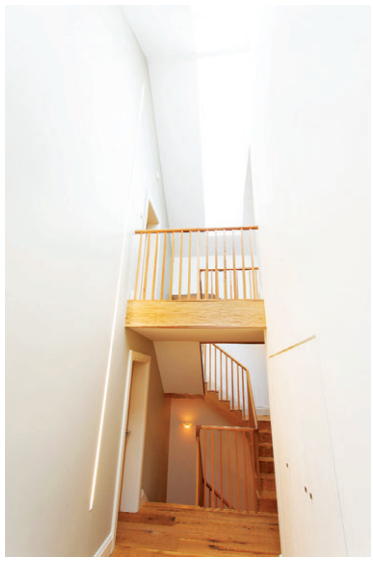
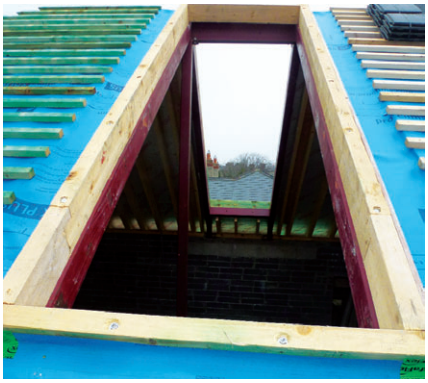
“We were left with this skeleton of a house. To be honest we were nearly afraid it would fall”





The reality was that the existing structure was not fit for purpose and ultimately only the bare minimum could be retained. “We were left with this skeleton of a house,” says Cyril Mannion. “To be honest we were nearly afraid it would fall, so we were tiptoeing around that for a while until we got it back up again.” Deemed unsavable, the left hand gable was demolished and rebuilt, with two courses of low thermal conductivity Quinn Lite blocks used to reduce cold bridging at DPC level.

While the structure was dry, the internal faces of walls had considerable mould growth in bathrooms and some bedrooms to the north of the house due to surface condensation.

The form of the building was driven largely by planning constraints and the client’s requirements. But though the passive imperative may have arrived post planning, Bright Design’s plan had in any case embodied many low energy principles. A dual aspect living space neatly captures solar gains from the south facing street, while a terrace in the front garden helps keep that space private and informal. In addition, the glazing strategy had also taken account of maximising solar gains without risking overheating. Roof glazing, for example, introduced heat and light into the core of the house via a stair course. ▶

Archie O'Donnell explains that with so many design elements fixed, he concentrated much of his efforts on the building fabric. "We would rather put the performance into the solid aspects, so overcompensate on walls, roofs and floors and then be able to reduce the spec on the high variable cost items; things like windows." While the windows are very high quality; triple-glazed and featuring class four airtightness, they are not thermally-broken passive certified units. The insulation strategy, as with so many deep retrofits, centred on wrapping the building in a thick, continuous layer of external insulation. According to window supplier Brian Raftery of True Windows, the company prides itself on the airtightness of its installations. "In today's built environment, the discerning clients are looking to a standard of 0.6 ACH for their building. The material we install meets this requirement time after time."

One of the most critical elements of the build lay in detailing the myriad junctions in order to deliver both the right aesthetic and the right thermal performance. Archie O'Donnell of Integrated Energy and Alan Burns of Bright Design drew up more than 24 separate construction details before the project went to tender. "There was a huge amount of time spent thinking about it and working it out," says O'Donnell. "There were very complex junctions with roofs, with existing walls to new walls and new thresholds with existing thresholds...It was the kind of thing that you must think out completely before you hit the site."

It was a painstaking, iterative process. The architect might begin with a detail of what he wanted to achieve aesthetically and the energy consultant would then add details on insulation and airtightness. These drawings were shared in the cloud, moving back and forth between them until each was agreed and finalised.

The detailing also captured how airtightness was to be achieved. While Intello membranes were specified as both airtightness layer and vapour check, again, the complex series of junctions in the house required detailed specification by the design professionals. And on-site, because airtightness is about process as much as product, delivering results required close attention to detail. Cyril Mannion erected a sign in the kitchen: 'This is an airtight building with underfloor heating. No drilling.'

Mark Shirley of 2eva performed two airtightness tests on the house. The first result came in at 0.7 ACH, well inside the Enerphit standard. "If we had done nothing else with it," he says, "that would have been an exceptionally good result because the building is large and architecturally complex." He points out that experience is key to getting a good airtightness result, and notes that the more projects a builder has worked on, the less materials he needs to achieve a set target.

The second test hit 0.63 ACH, which Shirley points out is on the cusp of full passive. "That's a 10 per cent improvement between first fix and final test...To have an Enerphit project into the realms of a new build passive house is quite exceptional."

According to lighting designer Rocky Wall of Wink Lighting, the lighting design was driven by energy efficiency without compromising on aesthetics. "The net result is a super-efficient lighting system that compliments the architecture of the building," says Wall, adding that downlighters were kept to a minimum to avoid compromising the airtight layer. "Also downlighters are a very poor light source," says Wall. "They were really only designed to highlight an object or a feature. They became fashionable because of their physical size as opposed to their illuminating ability." Instead the lighting strategy relies predominantly on LEDs and fluorescent lamps, including innovative dimmable LED wall lights.

Mechanical contractors Noel Geraghty Heating & Plumbing were responsible for installing the heating, plumbing, BEAM MVHR and central vacuum systems, solar thermal and rain water harvesting systems throughout the building. Given the stringent airtightness target of 1 ACH that the project had to hit, it was critical that all of the sustainable mechanical systems installed operated cohesively together without compromising the precious airtight layer. "There was very close coordination between the architects, consulting engineers, Cyril Mannion and the mechanical and electrical contractors to ensure that airtightness wasn't compromised," says Noel Geraghty, who has over 20 years experience in domestic, industrial and commercial installations. Service voids were built within the airtight layer with the main service penetrations entering the building via the sub floor. "We're very proud to have been part of this project and delighted to have contributed to its certification."

Ventilation required quite a bit of design work. It was decided that the house would be divided into two separate regions, each with its own MVHR unit, extracting and supplying the rooms in its half.

"The client was very particular about his acoustic requirements," says Alan Burns. "He didn't want sound transfer within reason between bedrooms and the hall, or between bedrooms and each other."

In order to achieve this, the bedrooms were fitted with drop-down acoustic seals, which were automatically lowered from within the door leaf when the door was closed. While this achieved the acoustic separation the client wanted, it interfered with the passage of air that the ventilation strategy required. In response, it was decided to extract and supply to each room individually, or, in the case of en suites, to extract from en suite and supply to its adjoining bedroom. Extra ducting was required to make this work, with additional acoustic attenuators to limit sound transfer via the MVHR system. There were also knock-on effects on the Enerphit calculations. The use of two systems required additional energy, which was compensated for by improvements to the fabric, and of course the better than expected airtightness performance.

But because all of these issues were modelled and thoroughly dealt with during the planning stage, the build itself progressed very smoothly. Contractor Cyril Mannion reports an overrun of ▶

(from top down) The original house; which ended up having to be virtually demolished; EPS was used to externally insulate the walls; the ductwork for the MVHR system inside the airtight layer; a thermal imaging test at 5C external temperature

PROJECT OVERVIEW:

Building type: 367 sq m renovation and extension to a 1960s detached house

Location: Donnybrook, Dublin 4

Completion date: September 2013

Budget: not disclosed

Enerphit certification: certified

Space heating demand (PHPP): 21 kWh/m^2/yr

Heat load (PHPP): 12 W/m^2

Primary energy demand (PHPP): 109 kWh/m^2/yr

Energy costs
Before: heating and hot water bills had been €4-5,000 per annum – and the building wasn't able to maintain 18C during the heating season.
After: an estimated total for heating/hot water of circa 8800/2700 kWh, totalling circa €850 per annum.

Airtightness (at 50 Pascals): 0.63 air changes per hour

Original walls: a combination of uninsulated cavity wall and single leaf nine inch hollow block walls. Upgraded/extension walls: Acrylic render finish on 200mm White EPS 90 insulation fixed to existing structure or to 215mm new blockwork walls. Hard plaster scratch coat to internal face of walls, 38mm battened service void with 12.5mm skimmed plasterboard finish. U-value: 0.17

Original ground floors: suspended timber floors, uninsulated.
Upgraded & extension ground floor: timber floor on 75mm screed with underfloor heating on 160mm PIR insulation on 200mm reinforced concrete slab on continuous radon barrier / DPM lapped and sealed on sand blinding on hardcore. U-value: 0.131

Original roof: cut timber roof with circa 100mm fibre glass insulation on attic floor.
New roof: Roadstone mini-slate concrete roof tiles fixed to treated battens, on a Pro clima Solitex Plus waterproof membrane over counter battens, on 60mm Xtratherm XT sarking board on timber joists [11%] on 225mm Metac glass fibre insulation. Continuous Intello airtight membrane taped and sealed with Pro Clima Tescon tape to underside of joists, with 60mm service void filled with Metac between battens. U-value: 0.115

Flanking roofs: as above on slope except with 175mm rafter, no plasterboard and no service cavity. Flat of flanking roofs includes Paralon roofing felt and 120mm of Paratorch insulation; 225 cellulose and Intello airtightness membrane. Slopes of flanking roofs include 80mm Xtratherm sarking board, and 175mm pumped Warmcel celluloseinsulation, and Intello airtight membrane.

Original windows & doors: double-glazed PVC windows, glazed hardwood front door and double-glazed hardwood windows and doors to rear utility.
New triple-glazed windows: HolzPlus timber aluclad frames with IV 78 windows and doors, class four for airtightness. Glass U-value of 0.6. Frame U-value for fixed unit: 1.0 Frame U-value for opening unit: 1.1

Roof windows: two bespoke triple-glazed Ruhm Flushlight roof windows. Centre pane U-value: 0.8. Two Fakro U6 roof windows with Thermo flashing system. Overall U-value: 0.81

Heating system
Before: standard efficiency gas boiler and radiator system.
After: 30kW 93% efficient Worcester Bosch Greenstar modulating condensing gas boiler with Heatmiser PRT-TS / PRT-NTS controls & radiators. Two 6.97 kW 81% efficient Gazco Studio 2 balanced flue – room sealed – gas fires.

Domestic hot water: 5 sq m Kingspan HP400 solar panels & 200L storage cylinder

Ventilation
Before: some wall vents.
After: Passive House Institute certified Dantherm HCH5 heat recovery units, with summer bypass, 77% efficiency (including air duct losses)

Lighting: predominantly LEDs and fluorescent lamps, including dimmable LED wall lights.

Water: Kingspan Water ENV100 Envireau Gravity System with 3000L storage capacity for flushing toilets and irrigating gardens

Green materials: cellulose insulation, GGBS

just three days. "It was all well planned," he says, "there were no major problems, no major hiccups."

SELECTED PROJECT DETAILS
Client: private
Architect: Bright Design Architects
M & E engineer: Ramsay Cox & Associates
Civil / structural engineer: Barrett Mahony Consulting Engineers
Energy consultant: Integrated Energy
Main contractor: Passive House Builders
Client's representative: McCarthy & Associates
Quantity surveyors: Duffy Gaffney Partnership
Landscape gardening: Doylescapes
Mechanical contractor: Noel Geraghty Heating & Plumbing
Electrical contractor: CTS Electrical
Airtightness tester/consultant: 2eva.ie
External insulation system: Sto
Below DPC wall insulation: Kingspan Aerobord
Sarking board & floor insulation: Xtratherm
Glass fibre insulation: Isover
Flat roof felt & insulation: Moy Materials
Cellulose insulation: Warmcel
Cellulose insulation installer: Ecowise
Thermal blocks: Quinn Lite
Airtightness products: Ecological Building Systems/Alfa
Windows & doors: True Windows
Roof lights: Ruhm
GGBS: Ecocem
Condensing boiler: Worcester Bosch
Solar array: Kingspan Renewables
Room sealed gas fires: Heating distributors
Underfloor heating & solar subcontractor: Base Engineering
Underfloor heating system: Hevac
MVHR & central vacuum syustem: Beam Central Systems
Lighting design: Wink Lighting
Rainwater harvesting: Kingspan Environmental

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Derbyshire upgrade blitzes Enerphit target

Hitting the Enerphit standard can be challenging for even the most seasoned passive house specialist, so what chances did Kate and Geoff Ball's semi-d have when the architect and builder had no passive experience? With a well-planned approach and no end of enthusiasm, they passed with flying colours, as **Kate Ball** explains.

We began house hunting late in 2009 as a couple with two small children and an interest in ecology and green building. We were looking for a bigger home which had the potential to be made more eco-friendly.

Having moved in May 2010 into a house which needed quite a bit of work doing, but which had the perfect location for us and a generous garden, we took a year to plan and decide that going all-out and doing a complete retrofit to the Enerphit standard would be the best long-term strategy in ecological, financial and comfort terms.

With our aims firmly in mind, in the summer of 2011 we approached ReDesign, a local architect with an interest in energy efficient and eco-friendly building practice, though no prior experience of passive house work. They helped us greatly to refine and finalise the general design and suggested Burton Building Solutions as the main builder – again, a business with an interest in learning more about energy efficient building but no passive house experience. We worked closely with the builders from the earliest design stages to ensure that as many as possible of the more complex elements of the design, from airtight layer continuity to elimination of cold bridges, could be dealt with before starting on site.

We borrowed the basic design for the retrofit from the fantastically detailed information Andy Simmonds [CEO of the AECB and partner in Simmonds Mills Architects] has provided for his Grove Cottage project, then used the AECB's details to refine certain elements. This allowed us to get reasonably close to Enerphit standards with the first iteration of the design, saving costs and allowing us to concentrate fully on the very unfamiliar demands of passive house retrofit.

As a team composed entirely of novices, we approached Alan Budden from Ecodesign Consultants to help us determine the feasibility of our ideas and to ensure that our end result would be able to be certified as Enerphit (provided we installed everything correctly).

Between all of us, the design was tweaked repeatedly, and then tweaked again when John Trinick from Warm did the certification PHPP modelling before we started the build.

For airtightness, Paul Jennings from Aldas looked over our protocol before the build and provided a day of training in the early build stages for all of the main people involved in the project. We believe this was instrumental in allowing us to achieve a good airtightness result, since afterwards everyone fully understood what would be involved in sealing the house.

Given that the house was habitable and large, if rather leaky, we decided to live in the house throughout the retrofit. We knew that with young children, living in the house during the build wouldn't be the easiest option, but we decided that the benefits of being on site throughout the project would far outweigh the discomfort (except for the bit where the floors were dug out – we camped out with family for two weeks!). This did result in a lot of moving of furniture (mostly into a storage unit) and lots of washing up in the bathroom basin, but was in the main good fun – though it would have been nicer in a less rainy year.

During the build, we encountered a variety of issues – from the asbestos tiles we found under finger parquet, which was itself under a carpet we removed the week before building started, to the discovery of a missing damp proof course in the original house walls, to the repeated flooding of the trench during below-DPC external wall insulation installation. This last issue led to the insulation floating off the walls repeatedly, until the main builder – rather than the specialist sub-contractor – suggested a pump to keep the trench empty. The pump had no level cut-out, so needed exhaustingly regular checking day and night to prevent burnout until the trench was backfilled.

The greatest worry we had during the build was about the airtight layer. Even with rather erratic external wall insulation contractors, it was a simple enough job to supervise and ensure that the brick parge coat was installed continuously. But we had read repeatedly about the dangers of weather exposure for airtight products, and the need to keep everything dry – and this in the wettest summer on record. Many hours were spent re-taping slightly wind-torn staple holes in the pitched roof Intello layers, and even slashing holes into the flat roof Intello to permit the lakes of water which had gone through the tarpaulins and the as-yet-unsealed OSB to flow into the utility room and allow the roof to dry out. We stuck to the rule of only putting airtight tapes onto completely dry substrates, and remarkably this seemed to work. The tapes didn't move at all, even in areas where the sequencing of external wall insulation with flat roof insulation meant that various sections of tape spent a fair while wet. Our final air test result of 0.32 ACH, with the only noticeable leakage around door locks and corners, would seem to indicate that our policy of doubling up all the airtight layers on the timber framed sections was a good idea, particularly since some of the OSB did get very wet, which may well have affected its airtightness.

The UK's favourable feed-in tariff meant it was financially (if not necessarily totally ecologically) viable to install solar panels. The 3.96kWp up-cycled panels from Innotech were installed by Ethical Solar. We were delighted to find a company upgrading seconds quality solar panels for more long-term use than solar powered toys. Meeting the deadline for the Autumn 2012 feed-in tariff reduction was difficult due to weather and sub-contractor related delays, and led to a strange construction sequence in which the south roof of the extension was fully sealed, insulated and tiled while the north roof still had only the I-beams in place. Due to the positioning of the house, the panels are pleasingly un-ostentatious – people who visit assume the house does not have them, which lets us lecture them on all the insulation and convince them that the house really is eco-friendly before solar panels are even considered!

One regret would be that as a novice team, we had so much to concentrate on that we did not manage to use the most environmentally friendly insulants, where contractors were determined to use more familiar products. This has led to the use of PIR in the project under floors and on the flat roof, when we would have preferred to use the same EPS as the external walls, if only to make recycling the house many years in the future simpler. Ideally, timber waste-based insulation would be our insulant of choice given unlimited space and finances.

Another slight issue – though this one was resolvable – was that the very large roof ridge beams provide our most noticeable thermal bridge. With our warm roof construction, this weirdly meant that snow melted from the ridge of our roof sooner than from the roofs of insulated (and I suspect under-heated) cold roof houses on the road. We intend to rectify this by installing 400mm mineral wool insulation under the ridge beam in the attics, to make the conductivity of the ridge area approximately equal to the conductivity of the rest of the roof.

Probably our favourite part of the project now is the MVHR – which is a surprise since we didn't expect it to work anywhere near as well as it has. It dried out the house beautifully when it was first turned on in the winter, making decorating rooms far faster than it would have been, and solving all the unpleasant damp issues which occur with a family-worth of laundry in a normal house in cold weather. In the summer, the filters are doing their work very nicely: Much as we love having open windows and hearing the birdsong, closed windows and a very low internal pollen count are helping the hayfever sufferers in the household no end.

The question of occupancy in a large house was something we were concerned about, having realised early on that while a small house with high occupancy will look worse on PHPP than a large house with low occupancy (since that works on floor area, not number of people), in real terms the energy used per person may well be lower in a smaller, less energy efficient house than in a larger, more energy efficient house. The first floor two-bedroom extension and utility extension left us as a family of four using two bedrooms of a five bed house. We have been lucky to find two additional housemates to bring our occupancy up to six, which seems a bit more reasonable for the space we have – and has the added advantage of helping to pay off the mortgage. Adding in a small child minding business and voluntary home educating groups all run from the house, the occupancy looks ▶

really quite good.

The calculated space heating demand comes in at 23.1kWh/m²/yr. Entertainingly, if you change our house from normal residential to student/old peoples' home, the figure drops to about 13 kWh/m²/yr. We're hoping we'll perform near this figure. We do actually have two students living in the house, and I work from home, run voluntary groups here and home educate our kids, so our occupancy is very high.

Part of our hope in undertaking this retrofit was to provide ideas for other people looking to improve the energy efficiency of their own homes. To this end, we joined the Superhomes network and are holding various tutorial sessions and open days throughout the year to help make simple energy efficiency measures more accessible to local people.

SELECTED PROJECT DETAILS
Client: Geoff and Kate Ball
Architect: Nigel Turner, ReDesign
Passive house Enerphit consultant: Ecodesign Consultants
Structural engineer: David Bayliss Consulting
Main builders: Burton Building Solutions
Airtightness trainer & tester: Paul Jennings, Aldas
External wall insulation: Permarock
Windows & doors: Green Building Store/Drewexim
Airtightness tapes, membranes & grommets: Ecological Building Systems
MVHR system: Paul Novus 300
Ventilation ductwork: Lindab
Flat roof waterproofing: Sarnafil
Solar PV: Ethical Solar

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PROJECT OVERVIEW:

Building type: 1950s east-west facing brick built two-storey detached house

Location: urban site, Derby

Budget: approx. £170k

Certification: Enerphit certified

Space heating demand
Before: 153 kWh/m²/yr
After: 23 kWh/m²/yr

Heat load
Before: unknown
After: 11 W/m²

Primary energy demand (PHPP)
Before: 403: kWh/m²/yr
After: 115 kWh/m²/yr

Energy performance certificate (EPC)
Before: The pre upgrade EPC stated the house had full loft insulation, full double glazing, full cavity wall insulation, full thermostatic control on the heating etc, none of which was accurate, rendering the EPC worthless.
After: Unknown

Energy bills
Before: £128 per month on gas and £37 per month electricity in 2011-12 (house occupancy 4)
After: £26 per month on gas and £30 per month electricity in 2013 (house occupancy 6)

Airtightness (at 50 Pascals)
Before: >10 ACH
After: 0.32 ACH

Ground floor: original floor dug up, adding 180mm PIR insulation with 100mm PIR down-stands to footings and 30mm phenolic up-stands to prevent slab contact with wall to reduce thermal bridging. Total floor U-value: 0.119

Walls
Before: (variously) unfilled cavity wall, solid brick wall, and mineral wool filled brick-brick cavity wall or brick-block cavity wall.
After: Permarock external insulation system including 250mm graphite EPS in two cross-bonded layers, airtight cementitious parge coat, external layer of brick, cavities all filled with mineral wool where cavity exists (cavity between 0 and 80mm on different walls), internal layer brick or block, again different construction on different walls. U-Value 0.102

Extension walls: timber frame walls – 250mm graphite EPS in two cross-bonded layers, airtight layers of taped 18mm OSB then taped Intello membrane; 100x50mm studs filled with mineral wool, then plasterboard. U-Value 0.100

Existing roof
Before: uninsulated slate roof with some mineral wool laid flat between ceiling binders but with many gaps in the insulation.
After: slates, battens, breather membrane, 18mm OSB, 400mm mineral wool between I-beams, taped Intello airtight layer then taped OSB airtight layer, pre-existing 3x2in rafters. U-Value 0.118

Extension roof: pitched roof as existing roof without 3x2 rafters. Flat roof has 70mm growing medium and mixed vegetation, water retentive and protective layers, Sarnafil waterproofing, 180mm PIR insulation in two cross-bonded layers, airtight layers of taped OSB then taped Intello membrane, roof joists filled with leftover graphite EPS then plasterboard. U-Value 0.085

Windows & doors
Before: rotten timber-framed single & double glazing
New triple-glazed windows: Green Building Store EcoPassiv Passive house suitable triple glazing with timber frames. U-Value 0.87-0.97

Heating system
Before: >25 year old gas boiler & 15 radiators
After: new gas fired Veissmann A rated combi using approximately three of the remaining seven radiators during last winter.

Ventilation
Before: no ventilation system. Reliant on infiltration, chimney and opening of windows for air changes.
After: passive house certified Paul Novus whole house mechanical ventilation systems with heat recovery, over 90% efficient, connected to Lindab steel ducting.

Green materials: re-use of existing carpets etc. where possible, FSC certified timber throughout build, use of reclaimed parquet through ground floor.

Electricity: 3.96kWp solar PV system

(below, l-r) Front facade with airtight parge completed; the front windows in place; extension wall onto utility roof showing cavity closure through joists; the house features a green roof with mixed vegetation; the rear of the house showing the timber frame extension;(p69) (bottom right, clockwise from top left) external wall insulation showing door overlapped by first layer and second layer being installed; faults in the insulation like this were foamed before the mesh coat was applied; two layers of insulation installed across frontage; insulation blocks being inserted into roof to ensure continuity as second layer insulation is installed






Passive house

GOES LARGE

Passive house is no longer just the preserve of the self-builder. With over 300 passive houses built to date in multi unit-schemes and a thousand more on the way – along with major non-domestic builds – increasing numbers of British & Irish developers are going passive. But how will the sector cope with upscaling, and will the most cost-conscious developers be attracted to the standard?

Words: Kate de Selincourt

This year's sell-out UK Passivhaus Conference, held in October 2013, took as its theme 'Passive House at Scale" – and there was palpable excitement about how many large schemes were coming through.

The opening talk was on the 53-apartment mixed-use Chester Balmore development built for Camden Council by Willmott Dixon (with design input from Rick Mather Architects and Architype), now nearing completion. Also featured was Sustainable by Design's Enerphit refurbishment at Gallions Housing Association's Parkview Hub – a five-storey concrete slab block containing 18 maisonettes, well under way.

Delegates heard about Architype's proposed 150-home 'Archihaus' development in Herefordshire, which now has planning permission, and hints of another 100+ home speculative development to go ahead using the Beattie Passive system. Completed schemes included the 41-home Lancaster Co-housing scheme, and Parsons and Whittley's two passive house developments (of 12 & 14 units) for Hastoe Housing Association – plus the news that Hastoe is building four more schemes.

Elsewhere, many other large passive house developments have been completed or are underway or planned in the UK and Ireland, including a good number of social housing schemes, and seven primary schools so far. While Ireland started in passive house before the UK and has gained some significant certified projects – such as a Tesco supermarket in Co Waterford and UCD student halls, both built in 2008 – larger passive projects have been few and far between since the recession. But this may be due to the unprecedented decline in construction activity in Ireland – where virtually no new housing schemes of any size have gone ahead in recent years, other than one-off self builds – rather than a lack of appetite for passive house.

How does passive house work at a scale larger

than the one-off private house? There are definite advantages. The most obvious, in the case of bigger single buildings and terraces, is an advantageous surface-to-floor area ratio.

A good form factor means it is simpler to achieve the required energy target – which can translate into more modest insulation values, or slightly cheaper windows or other components – or of course, even better performance.

As Peter Ranken of Tooley and Foster Partnership's consultancy Accredited Passivhaus Design put it about one larger building type: "As a building shape, care homes are already very efficient, with a lower ratio of external wall (heat loss) to floor area compared to detached houses. Therefore the step change to achieve passive house performance is smaller than other building types."

There can be economies of scale at the design stage too. A repeated detail gets great value out of the design input – so pouring maximum time and attention into optimising details in a larger build is well worthwhile. A great detail generally costs little or no more to build, but reduces the pressure to specify expensive high-performance components elsewhere. Construction may also be honed, and speeded up, through repetition.

Economies of scale can make it possible to consider passive house or Enerphit level retrofits that might otherwise appear uneconomic. (As Joseph Little told the Asssociation of Ireland's See the Light conference in Dublin in October, "Enerphit is not cheap unless delivered in bulk").

However, there are sometimes complications with getting a larger single building to the passive house standard. Additional energy-hungry services may have to be included, such as lifts, catering kitchens or sprinkler systems.

Most significant perhaps is the fact that you cannot always construct a bigger building on an insulated slab, because it may be too heavy. Sometimes it is necessary to confine insulation to a "skirt" round the foundations, though on occasion ingenious solutions have been deployed, such as the Interserve build at Richmond Hill Primary School in Leeds where "high-strength insulation normally used in industrial process plant installations" was used between the foundation piles and the steel frame.

On site

Do big passive house builds face extra challenges on site? One issue mentioned regularly is the need for good communication, and, ideally, continuity of staff. This can be harder to achieve where a big, mainstream contractor follows conventional practice and subcontracts on price, with frequent reviews and frequent changes of personnel.

As John Lefever, regional head of development at Hastoe Housing Association put it: "We used major housebuilders for our first passive house developments, but this time round we have gone with local SMEs, because they are more hands-on. We feel it will be easier to talk more directly to the people we need to talk to, and they tend to use their own in-house teams – with bigger guys they use subcontractors and they negotiate for new subcontractors all the time – they don't keep the same crews."

Larger firms can overcome this: at Thomas Vale Construction for instance, they have maintained continuity of both in-house staff and sub contractors through several passive house builds; Willmott Dixon tackled this at Chester Balmore by running an induction procedure for everyone who came on site.

Prefabrication

Several of the latest large passive house builds have opted for an offsite approach. Construction has just begun on a 51-unit development for Circle Housing in Rainham, on the Thames Estuary. The four blocks are being built by Climate Energy Homes using an offsite construction system. Prefabrication was also used to build the 23-home Sampson Close development for Orbit Housing, as is planned with Archihaus, in a factory to be established for the purpose. And prefabrication is also being used to form the cladding as part of the Enerphit retrofit at the Parkview Hub.

Alexander Gumpp of Gumpp and Maier, constructing the cladding panels for Parkview, believes prefabrication has to be the future: "In Europe we are spending too much on the process of building. We need to optimise work flows to increase the money going into the building – the bit the customer gets to keep."

The shortened time on site with prefabrication is a bonus – especially worthwhile in a retrofit where, as with the Parkview Hub, the job is taking place with occupants still in place.

Cost and client motivation

Despite some economies of scale, for larger passive house projects it is still common to hear there is a cost premium of something like 8% – much the same as with smaller builds. Not everyone thinks this is necessary: Architype (for both their schools and their Archihaus houses); Beattie Passive (houses built to their system, single or multiple) and Climate Energy (with their off-site build system) all say they can build passive house at or below conventional costs.

Nonetheless, the rapidly rising interest from clients in many sectors suggests that even where they do have to pay more, they feel there is a good business case for extra up front investment.

For those who will occupy the building, the financial case can be clear – extra investment often pays back pretty quickly in running cost savings. According to Peter Ranken, "the first passive house care home in Britain is reported to have cost 6% more, and the anticipated cost savings will pay this back in eight years."

Interserve Construction, who have built their own 600 sq m offices in Leicester and two passive house schools, have carried out calculations suggesting payback for passive house could be even faster. And as business development manager John Walkerdine points out, "when you look beyond that, with a life expectancy of 50 years or more you can see how the savings add up in the longer term."

Whole-life costing is becoming more common, so these considerations could increasingly sway clients towards passive house. However, there are still old barriers to break down, Walkerdine suggests: "There is traditionally a separation between facilities management budgets and capital budgets, especially in the public sector. Facilities management is not going to give estates a chunk of their budget to ▶

(opposite, clockwise from top left) Oakmeadow Primary School; Sulgrave Gardens; Dormont Estate; Chester Balmore; Kingstone; (this page, top down) CREST Pavilion; Lancaster Cohousing; Hadlow rural regeneration centre; Mildmay Centre; UEA Enterprise Centre

(clockwise from left) Moynalty primary school; Tesco store, Tramore; Roebuck Castle; Glen Ashling Nursing Home; (p76, clockwise from to left) Ditchingham; Sampson Close; Racecourse; Wimbish

enhance the building, even though it would cut running costs. Those budgets are a personal thing!"

"However, now that public spending is so squeezed, people have to start putting the two together – and we are seeing this starting to happen, in the NHS for example."

There could be less direct – but still highly financially worthwhile – benefits. Interserve compared sickness absences in the last year at their previous offices, with the first year at the new ones, and found a 13% decrease in sick leave. "An improvement like that is worth a lot of money to us," Walkerdine pointed out. While this is of course a single result, it echoes anecdotal reports from occupants of residential passive houses.

There are other good reasons to commission to passive house that also translate into a good business case, including for landlords who will not be paying the bills themselves. For social landlords, helping protect residents from fuel poverty is always an important part of their corporate mission; this motivation has led to the growing movement by social landlords in the UK to look beyond the statutory standards, and build and refurbish to passive house.

But it also makes financial sense. According to John Lefever of Hastoe "our first two passive house developments have been occupied for one and two years respectively, and to date we have had zero arrears." This is despite Hastoe having been obliged by the funder, the Homes & Communities Agency, to charge higher rents (this was Hastoe's motivation for going to passive house: they wanted to keep overall costs down for tenants). "Heating bills are only about £120 a year," says Lefever, "so although rents are higher, overall, our tenants are better off."

Neighbouring Broadland Housing Group are planning a 250-unit passive house apartment development, and chief executive Michael Newey believes social landlords should be allowed to charge higher rents to help finance more energy efficient homes – and if Hastoe's experience is repeated, everyone could be better off that way.

Perhaps unsurprisingly, in the commercial sector most interest to date "has come from PLCs who will be occupying their own building," says John Walkerdine. Might commercial landlords ever follow suit? They might, if the benefit from lower running costs here can also be shared with landlords via higher rents.

Interserve moved from "grim" former barracks buildings whose running costs were higher than the rent, into the passive house offices that they commissioned and constructed on a business park. The building was paid for, and is owned by, the park's developer, Raynsway properties. "We told the developer we would be able to pay a higher rent, because our running costs would be so much lower – we are now paying out less overall, even though we are now in a beautiful new building with higher rent.

"The property agent for our developer has really taken on board the advantages of our building, they realise it's the way to do it. It's about finding a way to sell that value, and get a good return to the developer while still benefitting the occupier."

Are valuations getting in the way?

Despite some powerful financial arguments, a client who wants to build to passive house at scale may still need to justify the expense in relation to the external valuation – and currently, these tend to be no higher than for a conventional building. This may be at least in part because passive house has barely been tested on the open market. Where it has (mainly with residential units), the buildings have sold well – though not necessarily at a price premium.

In London, some of the first passive homes available for private buyers have been in mixed developments built by social landlords (the profit from the private sales goes towards building the low energy affordable housing). Octavia Living, part of Octavia Housing, has built 29 passive homes in West London, of which eight were for sale on the open market. These houses have all been sold and occupied, reports Sue Dance, Octavia's head of sales and marketing: "For some buyers, the passive house features were the first attraction; for others it was the location, the finish, and the fact they have parking spaces! It was about 50:50.

"For the ones who were initially interested because of passive house, the low bills were definitely an attraction, and one family specifically wanted the filtered air, for health reasons. For the others, as they found out more about what the passive house features meant, I think this 'closed the sale'. And I can definitely say it did not put anybody off!"

The reaction in Camden has been similarly positive, with five of the first 15 Chester Balmore apartments already sold, as Passive House Plus went to press – only a couple of weeks after they were released, and only with local marketing. David Jubb of agent Savills was sure that passive house was an ingredient drawing people to the homes; not least because this was the same fortnight that saw a controversial round of energy price rises in the UK.

Despite selling prices being comparable with non-passive properties, both sets of homes are making a profit for the developer (though London house prices might make this easier here than elsewhere).

In Lancaster, the 20 members of the co-housing group needed to build and sell an additional 20 units for £20 - £40,000 more than the local rate for similar standard homes in the area, to make their site viable as a whole. And this wasn't a problem in the end, reports the project manager Jon Sear:

"We initially tried with a local estate agent, but they really didn't know how to market our houses. Fortunately we were able to sell them all directly, for the price we wanted, through our website and by word of mouth. And passive house was definitely a selling point."

Irish developer Joe McGowan shares this view and is backing passive house in a speculative development in North Wales. McGowan recently gained planning permission on a 12.5 acre site in Abergele, and has started on site with a 140-unit passive house scheme that will use Irish manufacturer MBC Timber Frame's system. "We'll have show houses up by March," says McGowan, adding that the scheme will consist of "conventional homes" released on to the open market, at the lower end of the market on price. While McGowan – who plans to have the homes passive house certified – agrees that the market may be willing to pay a premium for low energy housing, he retains only cautious optimism about the broader economic context. "Apart from London, the recovery has been slow," he says.

With the first big open market passive house housing developments now anticipated, all eyes will be on their commercial success. Despite the apparent reluctance of the UK government to follow Ireland's example and set good performance standards for building, it may be that as word spreads, more corporate bodies, more homebuyers, and more tenants in all sectors will seek the savings passive house offers, all the same. It will be interesting to see if, and how quickly, developers respond. ▶

Passive progress

In a far from exhaustive list, we've compiled this list of Irish & UK passive projects including multi-unit housing schemes and non-domestic buildings, but excluding one and two unit housing developments. Taking UK housing alone, our count includes over 300 units built and another 1000 planned or mid construction.

Residential – social housing

Completed

Tigh-Na-Cladach, Dunoon: 14 houses

Knight's Place: 18 apartments for Exeter City Council by Gale & Snowden

Racecourse, Houghton-le-Spring for Gentoo Housing: 25 bungalows designed by Mark Siddall

Bryce Lodge, Horsham: 12 houses on a development of 38, built by Osborne for Saxon Weald, designed by MH architects.

14 houses in Ditchingham, Norfolk & 12 houses at Wimbish, Essex by Hastoe & Parsons & Whittley Architects.

Dungannon, Northern Ireland: Five houses for Oaklee Homes Group, designed by Kennedy Fitzgerald Architects.

4 homes at Fulmodeston, Norfolk, by MOLE Architects for Broadland Housing Association.

Sampson Close, Coventry: 18 apartments & 5 houses, designed by Baily Garner for Orbit Homes.

4 houses for Fife Housing Association using Beattie Passive system.

Planned/on site

Hastoe has 100 units planned, including 14 homes at Hatfield Heath, Essex; 3 rental units at Horseheath, Cambridgeshire; 15 homes at Outwell, Norfolk; & 6 units at Burnham Overy Staithe, Norfolk

Private Housing

Completed

Dormont Estate, Lockerbie: Eight private rented houses designed by White Hill Design Studio.

Planned/on site

Grange Lough, Rosslare, Co Wexford: 8 units – 1 built so far, by Michael Bennett & Sons.

Cambridge K1 Co-housing community: plans for 36 homes.

Beattie Passive system licenced to a developer on a 100+ unit scheme in Sheffield, & have created Beattie Passive Norse, a joint venture with a commercial offshoot of Norfolk County Council offering low cost passive houses, including social (such as 12 houses with Great Yarmouth Borough Council and are currently in discussion to deliver a substantial social housing scheme in Nottingham).

250 apartments, Norwich, planned by Broadland Housing Association.

140-unit development in Abergele, north Wales by Joe McGowan.

Mixed use

Completed

Sulgrave Gardens, London: 30 units, by Cartwright Pickard architects for Octavia Housing.

41 unit Lancaster Cohousing development, Lancashire, built by Whittle Construction, designed by Eco Arc.

Planned/on site

Kingstone, Hereford: 150 units by Archihaus.

Chester Balmore, London: 53 units. Built by Willmott Dixon, designed by Rick Mather Architects for Camden Council.

51 units at Rainham, Essex by Circle Housing Group & Climate Energy Homes.

4 units, Islington, London, including 3 Enerphits and one passive new build. Designed by Bere Architects, with potential for larger scale roll out across Islington Council's existing stock.

Student accommodation

Completed

Roebuck Castle,Dublin: 130 student rooms, 3,000 sq m. Designed by Kavanagh Tuite Architects.

Residential care

23-bedroom extension to Glenashling nursing home, Co Kildare, built by MDY Construction.

Planned/on site

93 units for a UK housing association by Accredited Passivhaus Design.

Domestic retrofit

Planned/on site

Manchester: 32 unit Enerphit for Eastland Homes, design by 2e.

Portsmouth: 107 unit Enerphit for Portsmouth City Council, designed by ECD Architects.

Parkview Hub, London: 18 unit Enerphit for Gallions Housing Association by Sustainable By Design.

Offices

Completed

Canolfan Hygdden office and training centre in Machynlleth by JPW.

500 sq m Viking House in Dover built by WCR Property.

Retail

Completed

4000 sq m Tesco supermarket in Tramore, Co Waterford.

Planned/on site

Pharmacy & single apartment in Clonmel, Co Tipperary by Paul McNally Architect

Primary schools

Completed

Montgomery School, Exeter: designed by NPS South West, built by BAM; Oakmeadow & Bushbury Hill primary schools, Wolverhampton, designed by Architype & built by Thomas Vale); Leeds City Council's Architype-designed Swillington School and Space Architecture-designed Richmond Hill school, both constructed by Interserve.

Department of Education primary schools in Powerscourt, Co Wicklow and Moynalty, Co Meath, completed in 2012.

Planned/on site

Wilkinson primary school, Wolverhampton designed by Architype & built by Thomas Vale.

Tertiary and continuing education

Completed

Hadlow rural regeneration centre, designed by James Anwyl, built by Eurobuild.

Planned/on site

CREST Pavilion at South West College, Enniskillen: Designed by Paul McAlister Architects.

UEA Enterprise Centre, Norwich: Designed by Architype, built by Morgan Sindall.

Community & other non-domestic buildings

Completed

The Simmonds Mills designed Centre for Disability Studies, Essex & Green Base for Helena Housing, St Helens, Merseyside.

Mildmay Centre passive house retrofit, Islington, by Bere: Architects

Planned/on site

County archive building in Hereford, built by Kier Construction, designed by Architype.

1114 sq m church in Sheffield for Christ Church Central, designed by Architype.

Savoy Pier, a floating passive house building for Woods River Cruises, London, by Bere: Architects.

glossary

*Perplexed by all this talk of U-values, blower door tests and embodied energy? This latest instalment of our sustainable building glossary will help you get to grips with the key terminology. These entries will be added to an online glossary at **www.passive.ie/glossary**, which will continue to grow in detail as each new issue comes out.*

Air-to-water heat pumps use outside air as a heat source and delivers it to internal spaces via hot water (eg underfloor heating pipes) using electricity to boost the temperature.

Airtightness/pressure/blower door test This is used to work out a building's airtightness. A fan mounted to an external door or window is used to pressurise or depressurise the interior of the building, forcing air in or out through any gaps or cracks. The building's airtightness is determined by measuring the force needed to maintain a certain pressure difference (typically 50 pascals) between the inside and outside of the building.

Damp proof course A horizontal barrier in a wall that prevents moisture from rising. For a solid floor, the damp proof membrane provides the same function.

Enerphit This is the Passive House Institute's less onerous standard for retrofit projects. It demands airtightness of 1.0 air changes per hour (ACH) at 50 Pascals and space heating demand of 25kWh/m^2/yr (as opposed to 0.6 ACH and 15kWh/m^2/yr for certified passive house new builds).

EPS Expanded polystyrene, a type of plastic foam often used for rigid thermal insulation. It derives its insulating ability from air trapped within its closed cell structure.

Exhaust air heat pump This type of heat pump extracts heat from waste air leaving a building and uses it to provide hot water or space heating, using electricity to boost the temperature if needed.

Feed in tariff This is a fixed price per kWh that a government, one of its agencies or an energy supplier may pay producers of renewable energy for export of that energy to the electrical grid.

Hollow block This is a type of concrete block with two large cavities, each typically nine inches long. Commonly used for single-leaf construction in the greater Dublin area until modern times, some people attempt to retrospectively insulate hollow block walls by injecting insulation into the block work – a measure that should be avoided, due to the impossibility of ensuring continuous insulation. Not to be confused with cavity wall construction.

Internal heat gains means "free" heat is produced from within a building, such as by building occupants, lighting, cooking, or electronic equipment.

MVHR A technology that ventilates a building while also recovering heat from extracted air. MVHR systems typically extract warm, damp air from 'wet' rooms like kitchens and bathrooms and use it to heat cool, fresh incoming air, which is then usually piped to living spaces such as living rooms and bedrooms.

OSB Oriented strand board is an engineered wood label product made from altered flakes or strands of wood oriented in specific directions. It is available in a variety of thicknesses, and when its joints are taped and sealed it is sometimes used as the airtight layer on timber frame projects. Though this approach is taken on many passive house projects, it sometimes struggles to meet the highest levels of airtightness because the variable nature of the material leads to variable leakage rates.

Passive stack ventilation utilises temperature difference to ventilate a building. Because warm air is less dense than cold air, it will rise and subsequently leave the building if extractor vents are strategically placed. This will create a "chimney" effect that will draw in cooler air from intake vents below. Passive stack ventilation relies on the temperature inside being warmer than outside.

PHPP Passive House Planning Package, the spreadsheet-based software used to design and certify passive house projects. Available from the Passive House Institute.

PIR Polyisocyanurate, a type of plastic foam that is often used as rigid thermal insulation. It is one of the best performing (ie least thermally conductive) common insulation materials on the market. It derives its insulating ability from gases trapped in its closed cell structure.

Solar gain This refers to the heat energy that a building receives passively from the sun, normally through its glazing. Designing a building so that most of the glazing faces south, with little glazing facing north, is one of the basic principles of passive house design in the northern hemisphere. This helps to reduce the need for mechanical heating systems.

Solar thermal This is heat energy generated by the sun, usually via solar collectors such as flat-plate panels or vacuum tubes.

Steady state heat loss assumes that temperatures outside and inside a building remain constant for a sufficient amount of time, so the calculated heat loss is steady. In reality temperatures change constantly, so this is a simplification, but calculating the steady state heat loss during peak heating conditions is often used to size heating equipment.

Structural insulated panels consist of a panel in which insulation – typically plastic foam – is securely sandwiched between two structural boards (typically OSB, but also sheet metal, plywood, cement fibre and other materials).

Thermal break A building element of low thermal conductivity (ie good insulating ability) that is used to prevent the loss of heat at a specific point in the building envelope.

Thermal mass The capacity of a building material to store heat. Materials with a high thermal mass absorb heat, store it and then release it later on. This can help to smooth out extremes in temperature inside a building, helping to maintain a comfortable internal environment and reduce the need for heating. Heavyweight construction materials like concrete and bricks have more thermal mass than lightweight materials like timber.

Thermal conductivity This is the ability of a material to transfer heat by conduction, one of the three main ways that heat moves (along with convection and radiation).

U-value The U-value of a material is the rate of heat loss through that material. The lower the U-value of a material, the less heat can pass through it and the better it is at insulating. U-values are measured in watts per metre squared kelvin (W/m^{2}K).

Vapour check/vapour control layer A material that is designed to significantly reduce the transfer of water vapour through a building element (e.g. wall or roof). They are often installed on the warm side of a construction to prevent water vapour from reaching the colder elements and condensing.

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